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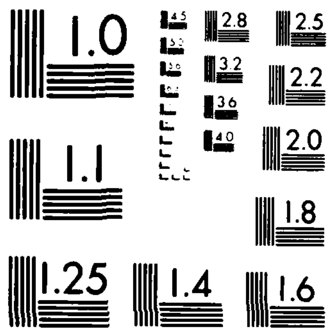
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AD-A149 915

M-X/MPS

ENVIRONMENTAL

TECHNICAL REPORT

PRELIMINARY FEIS

REVIEW COPY 2 OCTOBER 1981

ETR 24
POWER AND ENERGY

DEPLOYMENT AREA SELECTION
AND LAND WITHDRAWAL/
ACQUISITION

DEPARTMENT OF THE AIR FORCE

M-X ETR-24

ENVIRONMENTAL CHARACTERISTICS OF ALTERNATIVE DESIGNATED DEPLOYMENT AREAS: POWER AND ENERGY

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Prepared for

United States Air Force
Ballistic Missile Office
Norton Air Force Base, California

By

Henningson, Durham & Richardson, Inc.
Santa Barbara, California

REVIEW COPY OF WORK IN PROGRESS

2 October 1981

DEPARTMENT OF THE AIR FORCE
WASHINGTON 20330

OFFICE OF THE ASSISTANT SECRETARY

Federal, State and Local Agencies

On October 2, 1981, the President announced his decision to complete production of the M-X missile, but cancelled the M-X Multiple Protective Shelter (MPS) basing system. The Air Force was, at the time of these decisions, working to prepare a Final Environmental Impact Statement (FEIS) for the MPS site selection process. These efforts have been terminated and the Air Force no longer intends to file a FEIS for the MPS system. However, the attached preliminary FEIS captures the environmental data and analysis in the document that was nearing completion when the President decided to deploy the system in a different manner.

The preliminary FEIS and associated technical reports represent an intensive effort at resource planning and development that may be of significant value to state and local agencies involved in future planning efforts in the study area. Therefore, in response to requests for environmental technical data from the Congress, federal agencies and the states involved, we have published limited copies of the document for their use. Other interested parties may obtain copies by contacting:

National Technical Information Service
United States Department of Commerce
5285 Port Royal Road
Springfield, Virginia 22161
Telephone: (703) 487-4650

Sincerely,

JAMES F. BOATRIGHT
Deputy Assistant Secretary
of the Air Force (Installations)

1 Attachment
Preliminary FEIS

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SUMMARY

The M-X program will require electric power and fuels of various forms supplied on both a relatively short term (5-7 years) for construction needs, and a longer term (about 30 years) for operational requirements. At a time of diminishing energy supplies and increasing competition for energy, including gasoline, the potential effects of the project on energy resources must be considered. The majority of the information in this report represents the best available data as of June 1981.

ENERGY RESOURCES AVAILABLE

Fuel supplies are more readily available in the Texas/New Mexico region than in the Nevada/Utah region because of the greater population and the petroleum and natural gas related industries. Underground pipelines carrying natural gas, crude oil, and refined products are more extensive in Texas/New Mexico. Natural gas is the common heating fuel in that area, while in Nevada/Utah, Number 2 fuel oil, bottled gas and electricity are prevalent. Projected consumption quantities and existing and proposed pipeline plots are presented in the following section.

Electric power is generally available on a regional basis. The Nevada/Utah deployment area could be served by utilities (federal or commercial power suppliers) in the Western Systems Coordinating Council (Regions 25, 27, and 28). The Texas/New Mexico deployment area is served by utilities in the Southwest Power Pool (SWPP). Both areas have sufficient projected available reserve margin, providing proposed projects are not delayed. The existing high-voltage transmission system in Texas/New Mexico is more extensive than in Nevada/Utah.

The M-X deployment sites are in regions of high available solar radiation. For this reason, the M-X deployment areas are particularly amenable to the use of solar energy systems. Also, currently available weather and geologic data indicate the existence of potentially significant wind and geothermal resources. To determine if the use of wind and geothermal energy at the M-X deployment sites is feasible, site specific measurement programs have been initiated by the M-X/RES Project to better quantify these resources. Chapter 5.4 describes the M-X/RES Project and Chapter 6 describes renewable energy technologies.

ENERGY REQUIREMENTS

Energy requirements have been estimated for M-X technical facilities, housing on and offbase for both military and civilians brought to the region, transportation, and equipment operation. A summary of energy requirements by deployment alternative is presented in Section 2.

Between the peak M-X construction and operation year 1986 and the full operations 1992 phase, the annual gasoline consumption for the Proposed Action is expected to fall from about seven to four percent of the projected Nevada/Utah consumption without M-X. For Alternative 7, located in Texas/New Mexico, the annual gasoline consumption would fall from about 0.6 to 0.4 percent for that two-state region. Similarly, distillate fuel oil (includes heating fuel, diesel, and jet fuel) requirements for the Proposed Action would fall from 11 percent to 6 percent of the two-state consumption; for Alternative 7 from one to 0.8 percent. Natural gas is

not considered to be used extensively in Nevada/Utah. For Alternative 7, annual natural gas consumption would be less than 0.03 percent of the Texas/New Mexico region during both construction and operations.

The electric power requirements are estimated to decrease from about 368 Mw to 250 Mw between the peak construction and operation year 1986 and the operations phase 1992. Approximately 114 Mw are associated with the Designated Deployment Area facilities. The 368 Mw is about 2.1 percent of the projected 1986 actual reserve margins of the Nevada/Utah electric region (Regions 27, 28, and 25), and varies from about seven percent of the Texas/New Mexico electric region actual summer reserve margins (Region 22).

IMPACTS ON FUEL SUPPLIES

The peak demand for gasoline and diesel fuel occurs during the construction stage. During the subsequent operations period, the requirements for gasoline reduce to approximately 50 percent of peak construction demand; diesel fuel requirements reduce to about 57 percent of the peak demand. This condition applies roughly for all basing alternatives examined.

One indication of the possible fuel impact caused by the M-X project on fuel availability can be seen by comparing M-X fuel requirements to projected national fuel consumption for the peak construction and operation year (1986). M-X requirements for gasoline would then represent about 0.08 percent of the annual (1986) national consumption and approximately 0.5 percent percent of the annual national diesel fuel consumption. Thus, with reference to national requirements, the overall impact on fuel availability for all M-X alternatives would appear to be low.

There remains the problem of adequate distribution of the national supplies to local areas, however. With reference to projected state consumption of petroleum supplies, the situation in Texas/New Mexico looks favorable because the peak M-X requirements in 1986 would represent only a few percent of predicted state usage of gasoline and diesel fuel without the M-X project. In Nevada/Utah, the peak gasoline requirements for M-X construction would temporarily reach approximately seven percent of predicted gasoline consumption without M-X, and 11 percent of projected distillate fuel oil (includes heating oil, diesel, and jet fuel) consumption. Thus the demand for new storage, distribution facilities, and pipelines would be considerably greater for the Nevada/Utah basing alternatives. The peak demand would be temporary, would and reduce to a more moderate increase during the M-X operations phase. There will be adequate time for an orderly expansion of permanent storage and distribution facilities and the overall impact on the availability of fuels in the Nevada/Utah region will be low.

In an effort to explore potential mitigation measures, the Air Force is conducting a M-X Alternative Fuels and Transportation Study. This study assesses the feasibility of using alternative fuels, higher efficiency engines, and alternative vehicles to satisfy the transportation and fuel requirements of M-X construction and operation.

The allocation of sufficient fuel and local markets currently depends upon free economic forces of supply and demand. During the preparation of the DEIS, some reliance was placed upon the existing federal allocation controls provided by the

Emergency Petroleum Allocation Act of 1973 (EPAA) as administered by the Department of Energy's Economic Regulatory Administration (ERA). Under the ERA rules, increased allocation of petroleum products could be made to regions suffering undue shortages from increased population growth and construction.

However, on January 28, 1981, President Reagan ordered the elimination of all remaining federal controls on U.S. oil production and marketing. The gasoline allocation regulations were cited "as important causes of the gas lines and shortages that plagued American consumers on and off since 1974." President Reagan announced that "ending price controls is a positive first step towards a balanced energy program, . . . free of arbitrary and counterproductive constraints . . . "

Present supplies of gasoline and fuel oil are plentiful. Yet the federal government is supporting a broad program to further reduce U.S. dependence on foreign oil. Also, it should be noted that statutory authority for federal allocation controls remain in the EPAA, which expires September 30, 1981. The U.S. Senate Energy Committee initiated hearings in May 1981 to determine if the 1973 Act should be renewed or alternative approaches taken.

There exists federal statutory authority to implement gas rationing under certain conditions. Thus, federal controls on oil production and marketing have been removed, in part to improve distribution. If controls are needed, they can be reinstated in some form. But in view of present and projected world and national supplies, and national policies, the availability and equitable distribution of these fuels to the M-X areas without undue impact appears feasible for all alternatives.

The impact of a possible international embargo, such as the 1973 embargo by the Organization of Petroleum Exporting Countries (OPEC), has not been examined. The likelihood of such an embargo and its impact in the light of possible federal government action are too speculative to warrant detailed treatment now. Yet it is generally agreed that the energy posture of the United States in the event of such an emergency, is much better now that it was in 1973.

A broad program to reduce U.S. dependence on foreign oil, including price decontrol, increased exploration and drilling, synthetic fuels development, and the Strategic Petroleum Reserve will help to ensure adequate fuel supplies.

New pipelines, storage, and distribution facilities have not yet been sited, but are not considered to be extensive. Alternative locations will be considered in subsequent decision documents. Localized impacts related to construction of petroleum and natural gas handling facilities are expected to be minor. If a central cooling and heating facility (CCHF) is incorporated and operates on coal rather than oil, the environmental impacts will be greater, relating to air quality, water supply and wastewater disposal.

IMPACTS ON ELECTRICAL POWER SUPPLIES

The Air Force's current baseline plan is to purchase power to operate the M-X system. In both regions, proposed new power plants and additions to existing facilities should be more than sufficient for M-X electrical needs, however, plans for new capacity do not specifically include M-X requirements. The Air Force recognizes the need to reserve future capacity for M-X loads, and it is currently

discussing power needs with suppliers. However, no commitments can be made until the M-X deployment area is selected.

Another option available is for the Air Force to build its own power facility. This facility is discussed more fully in Section 2.5.3. A third option being examined is a joint program with the Department of Energy involving the use of renewable energy sources for M-X. Also under consideration is the use of stand-alone energy systems with the DDA.

Expansion of power transmission and distribution systems would be required to a greater degree in Nevada/Utah than in Texas/New Mexico. These facilities may produce unaesthetic and right-of-way impacts in pristine areas. The extensive cable plowing or trenching required for installation of underground cables for power distribution to the clusters may have a temporary disruptive effect, although this installation of underground cables to the clusters will be confined where possible to the right-of-ways associated with the M-X road network.

Information concerning M-X transmission and distribution facility locations has not been developed. More detailed impacts analyses will be presented in subsequent tiers of the environmental process. The potential impacts to local vegetative cover, wildlife, and scenic resources would most likely be of low significance where aerial and underground lines are located along existing or M-X project roads.

MITIGATIONS

The following discussion presents mitigative measures to reduce potential impact to energy resources.

The potential for replacement of conventional sources with alternative energy sources will be investigated. A major DOD-DOE program is underway to develop alternative energy systems that can provide reliable operating power for the M-X system and accelerate the broad application of renewable energy system (RES). Technologies under study include solar thermal, photovoltaics, wind, geothermal, biomass, and energy storage. The program includes resource assessment and application, candidate systems development, and systems integration at three power levels - the shelter, the cluster, and the operating base. The strategy is to support a diversity of approaches, including stand-alone shelter systems, intermediate-scale interconnections, and large-scale OB configurations, with or without utility grid or primary fossil backups. The decision to implement RES will depend on a comparison with a baseline power system using conventional energy sources. At the operating base, geothermal, biomass, wind and solar power plants could be used. In the DDA, wind and solar systems could be used. Alternative and renewable energy systems will be used where feasible.

Passive and active solar systems for space heating, space cooling and hot water in M-X facilities and in new housing will be utilized to the extent practical. Passive solar energy design includes correct building siting and orientation, amount of southern glazing exposure, appropriate overhangs, insulation, inclusion of thermal mass for storage in floors and walls, and venting and ducting for controlled movement of air through a structure. Passive solar design can save up to 70 percent of the heating loads, and 10-20 percent of the cooling loads depending on climatic conditions.

Active solar energy design typically utilizes flat plate collectors and a working fluid for space heating and hot water production. Such systems could supply about 50 to 60 percent of the domestic hot water load for new residential housing.

The base comprehensive plan currently being prepared will utilize the following energy conservation guidelines: minimize energy expenditures, make optimal use of renewable energy resources, plan for future energy flexibility, evaluate and incorporte conservation systems, use energy-efficient construction concepts and systems and technologies. During planning and design, emphasis is being placed on energy conservation in the mechanical, electrical, and lighting systems. Operating bases will use centralized and computerized energy management and control systems.

Energy conservation programs will be implemented. For example, electric power consumption for lighting could be reduced by 30-35 percent through the reduction of interior and facade lighting and also by the use of more efficient lights, such as lower wattage incandescent or fluorescent lights. This application could also reduce the cooling loads of the buildings. Other electric savings could be achieved by the installation of high efficiency motors, applicances and load management devices. These measures combined could save up to 15 percent of the total electric consumption of bases and new homes in the surrounding communities.

Installation of high efficiency hot water heaters, insulation of hot water tanks and pipes, and reducing the hot water set temperature to 120°F could reduce domestic hot water energy consumption by 10 percent.

Close coordination with local utilities will be maintained so as to minimize impacts, to the maximum extent possible, associated with energy transmission and production facilities that will be installed and/or modified as the M-X system is implemented (see Appendix A). In many cases, the selection of specific sites and rights-of-way can contribute most toward the mitigation of impacts. Utilities may select transmission line structures designed for minimum right-of-way requirements, and substations may be of the low-profile type to avoid the cluttered appearance of highbay lattice design.

In addition, the design and selection of colors and materials for substation fencing and transmission towers can be coordinated with landscaping to provide a pleasing appearance that blends with the surroundings. Consideration can also be given to the aesthetic appearance of free-standing towers and structural supports for communications and control equipment. The configuration of conductors can be designed to minimize right-of-way requirements, allowing a possible reduction in the clearing and trimming of vegetative cover. Similar mitigative measures are possible for petroleum and natural gas facilities. Aesthetic considerations will be emphasized in right-of-way selection. Joint right-of-way use will be explored wherever possible.

Beyond the above discussion of mitigation measures, central cooling and heating facility (CCHF) is being considered in order to achieve greater energy savings for all the buildings and residences on the operating base.

Energy requirements used for analysis do not reflect the use of conservation measures. Rather, applicable ASHRAE codes were used to develop the demand

scenario. This allowed a worst-case analysis of the energy demand. Energy requirements if conservation measures are implemented are presented in Table 5.2.3.1 of ETR-24. Also, ethanol can be used as an internal combustion engine fuel in the form of gasohol, dieselhol, or straight ethanol. If gasohol or dieselhol becomes available at competitive costs, up to 10 percent of the gasoline and diesel fuel requirements could be supplied by ethanol, an alternative energy source.

INTRODUCTION

This energy report documents information that further explains the significance of impacts identified in the Environmental Impact Statement for the M-X project and shows how the Air Force plans to mitigate them. Deployment of the M-X system would be a large-scale defense project in Nevada, New Mexico, Texas, and Utah, that would involve 33,546 temporary construction workers and permanent military and civilian employees during peak construction and operation period. The project would include construction of approximately 9,000 miles of new roads, that will be open to the public after construction, assembly and check out are completed. The M-X system's two permanent operating bases would constitute large new employers. Among other effects, the in-migrant workers and USAF employees would cause large increases in traffic and energy consumption.

The following discussion describes the energy resources now available in the proposed M-X deployment regions, the energy requirements that would be needed, when energy would be needed, and how energy usage would affect the continued availability of resources. The potential impacts of the energy and power distribution systems are analyzed.

The report begins with an analysis of potential regional energy impacts and continues through to an analysis of site-specific impacts for each M-X deployment alternative. Each analysis identifies the cause-and-effect relationships within its region or alternative. After presenting the analyses, the report describes ways in which to mitigate the identified impacts. This report briefly describes alternative energy technologies and their potential for augmenting the energy resources currently utilized in the M-X deployment areas, and also energy conservation measures that may be employed with an estimate of possible energy savings.

1.0 ENERGY SUPPLIES

1.1 ELECTRIC POWER

The electric power industry in the United States is divided into nine regional electric reliability council areas as shown in Figure 1.1-1. The regional areas are divided into subregions for the contiguous United States. Figures 1.1-2 and 1.1-3 show that the Nevada/Utah study area is serviced by Regions 25, 27, and 28 of the Western Systems Coordinating Council (WSCC), and Figures 1.1-2 and 1.1-4 show that the Texas/New Mexico study area is serviced by Region 22 of the Southwest Power Pool (SPP).

National and regional electrical summer peak demands and annual consumption projected to 1986, as well as 1978 (latest available baseline consumption data) electrical production for the states of Nevada, Utah, Texas, and New Mexico are shown in Table 1.1-1.

Projected electrical peak demands and minimum reserves available for summer or winter conditions for the DDA, without the M-X system, are shown in Table 1.1-2 for Nevada/Utah, and in Table 1.1-3 for Texas/New Mexico. Actual reserves represent the difference between operable resources and peak demand for each electrical system.

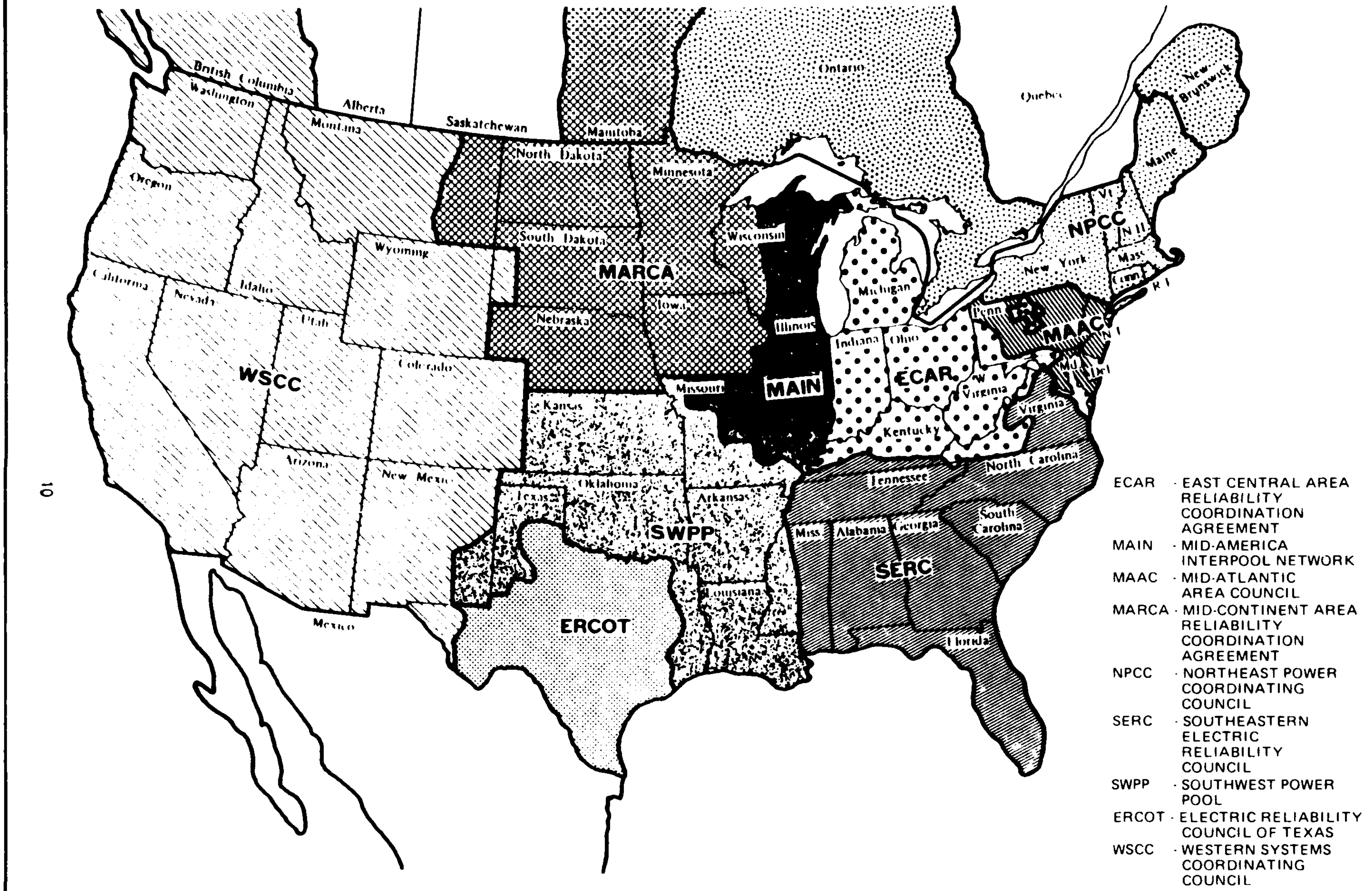
Existing generating units near the Nevada/Utah deployment region are shown in Table 1.1-4, and near the Texas/New Mexico deployment region are shown in Table 1.1-5. Projected generating units near Nevada/Utah and Texas/New Mexico deployment regions are shown respectively in Tables 1.1-6 and 1.1-7.

Plots of existing and proposed transmission lines are presented for the Nevada/Utah region, and the Texas/New Mexico region in Figures 1.1-5 and 1.1-6 respectively.

1.2 PETROLEUM PRODUCTS -- LIQUID FUELS

The liquid fuels required for the M-X system and support communities would be diesel fuel (includes JP4), gasoline, and No. 2 fuel oil. Baseline consumption data for 1978 and projected 1985, 1990, and 1995 estimates of consumption of liquid fuels are presented for the United States in Tables 1.2-1, 1.2-2, and 1.2-3. These figures are based on data from the Department of Energy, Energy Information Administration (DOE/EIA).

The DOE/EIA projections are calculated, in part, on the assumption that current Federal Government policy will continue into the future. However, the uncertainty surrounding future oil supplies requires that energy projections be made for a wide range of possible oil prices. An analysis of the world oil market provided a basis for three separate assumptions, low, middle, and high, as a basis for all energy market projections reflected in the tables listed above. Because future world oil prices are a dominant source of uncertainty in domestic market projections, as well as uncertainty about the other factors affecting future energy prices, the current EIA projections for energy consumption are made using three alternative crude oil price trajectories as shown for projected fuel consumption in Tables 1.2-2 through 1.2-4.



SOURCE: DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION

APRIL 1978

Figure 1.1-1. Regional electric reliability council areas.

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Table 1.1-1. National, regional, and state electrical peak demand and power consumption.

	Peak Demand (MW)	Consumption (10^3 MWH)
Contiguous US (Summer 1986)[1]	513,984	2,833,967
WSCC Region (Summer 1986)[2]	90,796	553,641
Nevada Production (1978)[4]	--	12,940
Utah Production (1978)[4]	--	8,627
Total(Nevada and Utah)		21,567
SPP Region (Summer 1986)[3]	53,198	264,389
Texas Production (1978)[4]	--	184,054
New Mexico Production (1978)[4]	--	19,577
Total(Texas and New Mexico)		203,631

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[1]DOE/EP-0022 Electric Power Supply and Demand for the Contiguous United States,1981-1990 (July 1981).

[2]*Western Systems* Coordinating Council - "Coordinated Bulk Power Supply Program" 1980 -1990 (April 1, 1981).

[3]Southwest Power Pool - "Coordinated Bulk Power Supply Program" (April 1, 1980).

[4]DOE/EIA-0049 (79) Energy Data Report-"Power Production, Fuel Consumption, and Installed Capacity Data for 1979 (Final)" (June 12, 1980).

REGIONAL RELIABILITY COUNCIL AREAS	IDENTIFICATION
ECAR	EAST CENTRAL AREA RELIABILITY COORDINATION AGREEMENT
1	Allegheny Power System (APS)
2	American Electric Power System (AEP)
13	Central Area Power Coordination Group (CAPGO)
14	Cincinnati, Dayton Group (CD)
15	Kentucky Group
16	Indiana Group - All Indiana utilities except I&M
18	Michigan Electric Coordinated Systems (MECS)
ERCOT	ELECTRIC RELIABILITY COUNCIL OF TEXAS
23	Texas Interconnected Systems Group (TIS)
MAAC	MID-ATLANTIC AREA COUNCIL
5	Pennsylvania-New Jersey-Maryland Interconnection (PJM)
MAIN	MID-AMERICA INTERPOOL NETWORK
6	Commonwealth Edison Co.
17	Illinois-Missouri Group (ILLMG)
19	Wisconsin-Upper Michigan Systems Group (WUMS)
MARCA	MID-CONTINENT AREA RELIABILITY COORDINATION AGREEMENT
20	Mid-Continent Area Power Pool (MAPP)
NPCC	NORTHEAST POWER COORDINATING COUNCIL
3	New England Power Pool (NEPOOL)
4	New York Power Pool (NYPP)
SERC	SOUTHEASTERN ELECTRIC RELIABILITY COUNCIL
7	Florida Coordinating Group (FCG)
9	Southern Company Group
11	Tennessee Valley Authority Group (TVA)
12	Virginia-Carolinas Group (VACAR)
SWPP	SOUTHWEST POWER POOL
8	Middle South Utilities/Gulf States Utilities Group
21	Missouri-Kansas Group (MOKAN)
22	Oklahoma Group
WSCC	WESTERN SYSTEMS COORDINATING COUNCIL
24	Rocky Mountain Power Pool (RMPP)
25	Northwest Power Pool (NWPP)
26	Arizona-New Mexico Group
27	Southern California-Nevada Group
28	Northern California-Nevada Group

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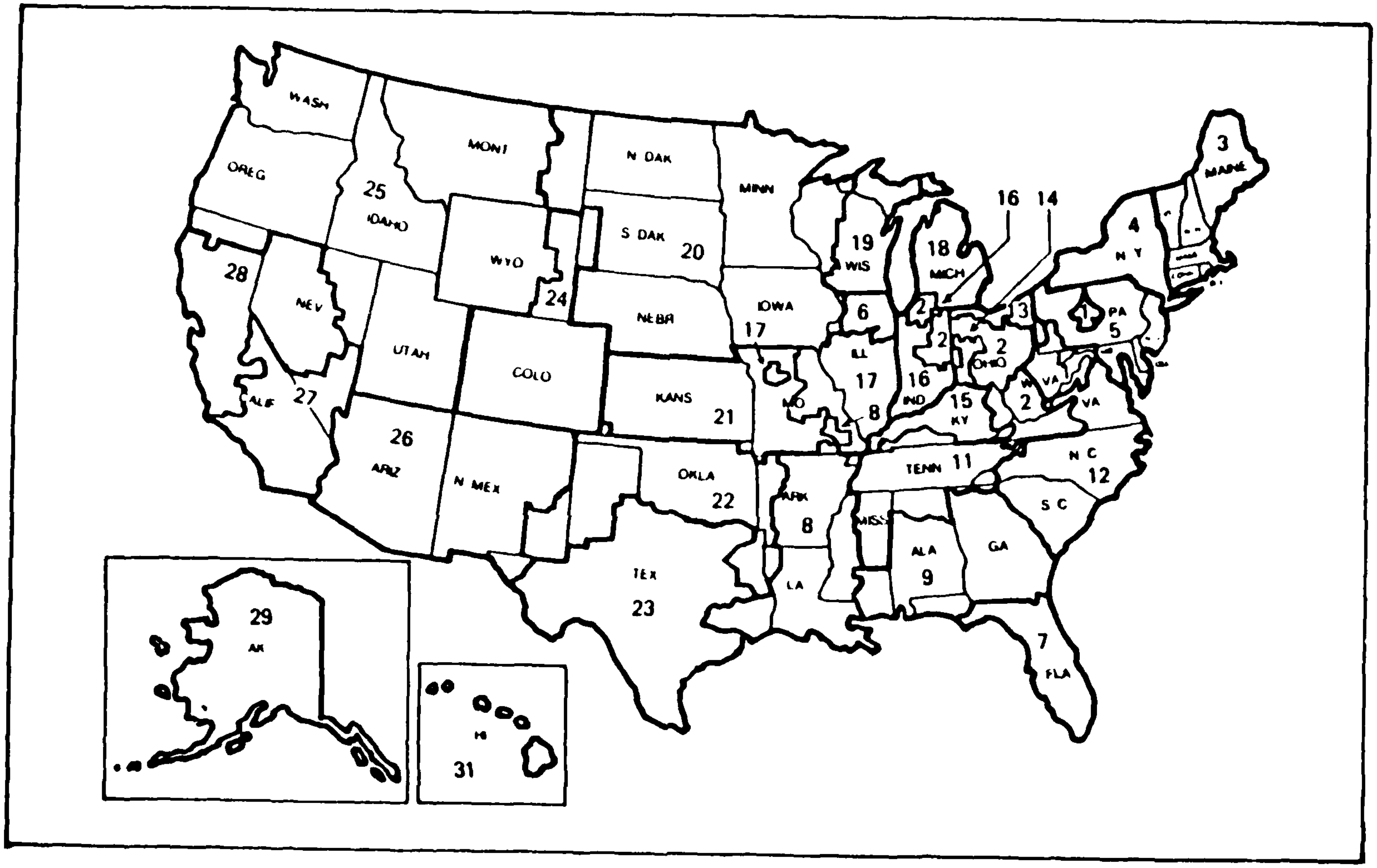

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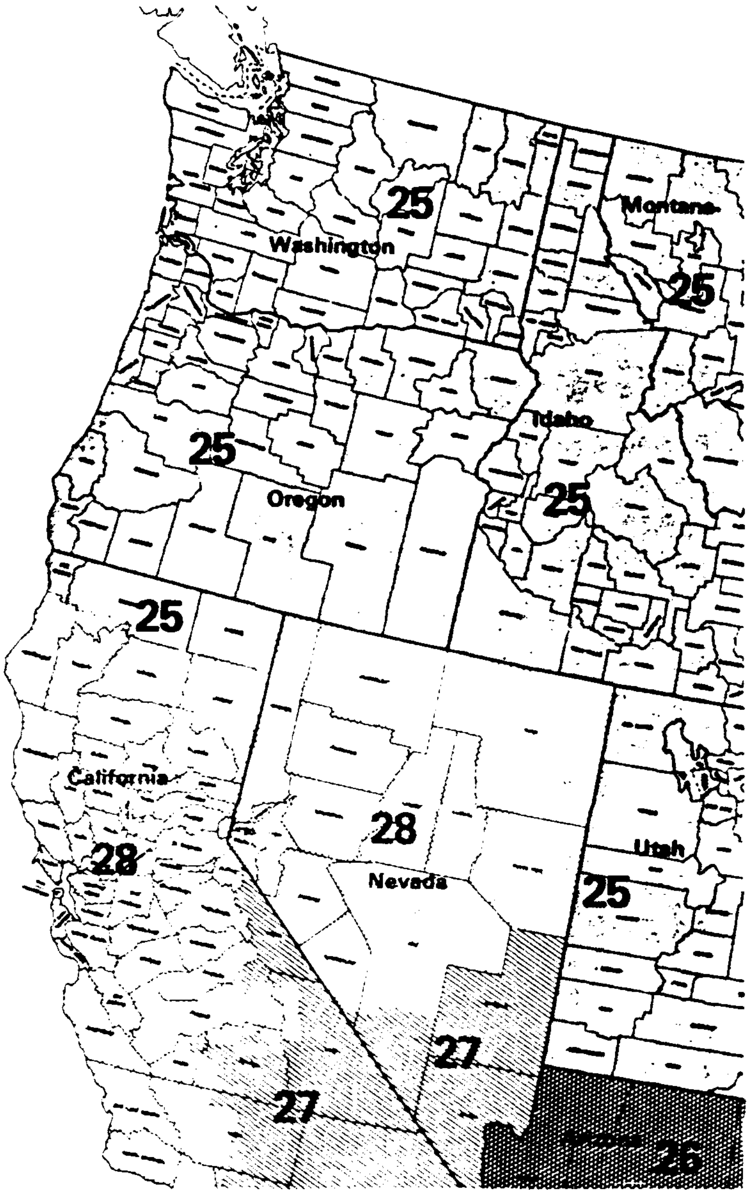
Figure 1.1-2. Electric regions in the United States.



Legend

25 Northwest Power Pool (NWPP)

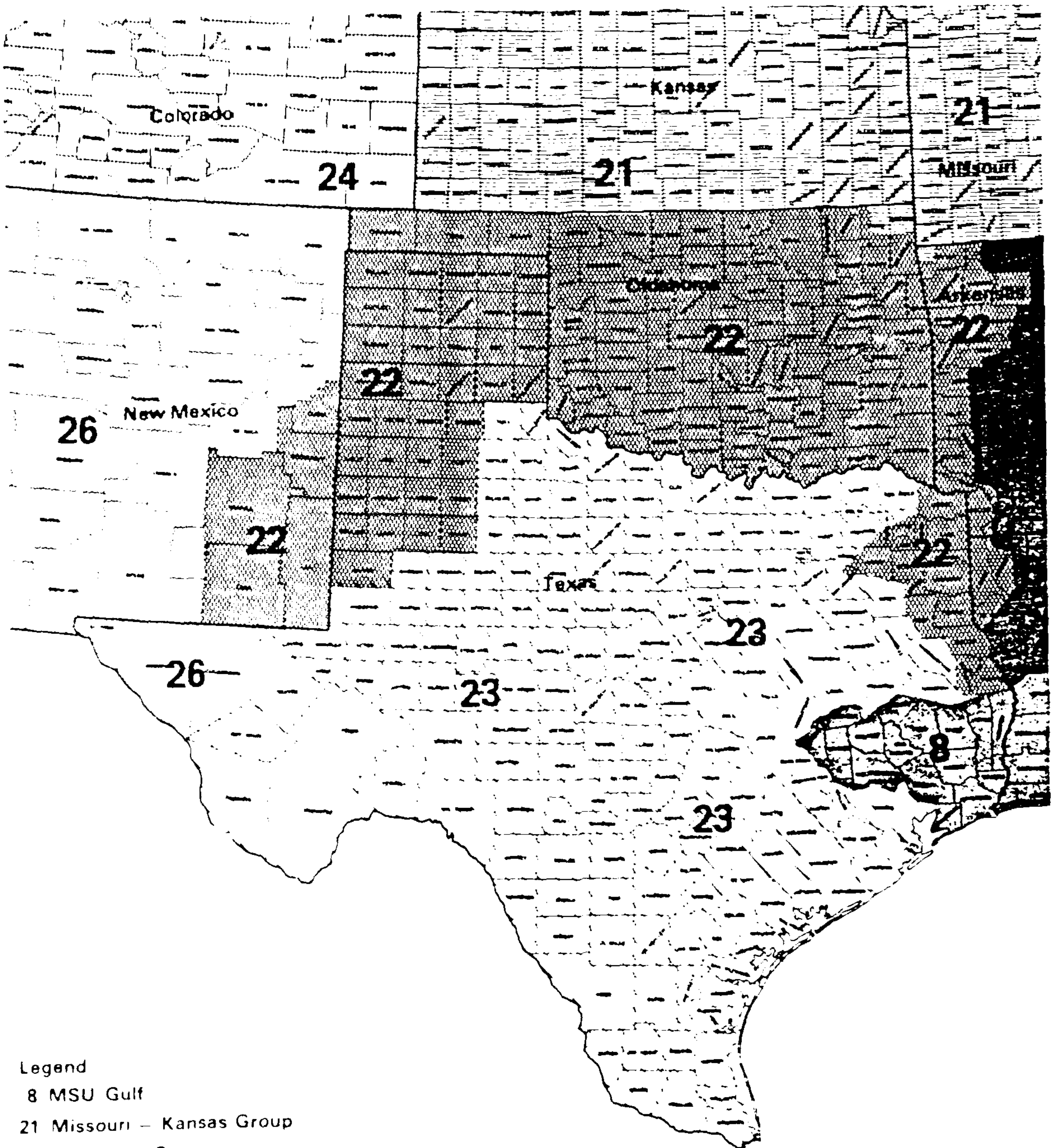
26 Arizona — New Mexico Group

27 Southern California — Nevada Group

28 Northern California — Nevada Group

SOURCE: DOE/ET-0022, ELECTRIC POWER SUPPLY DEMAND FOR CONTIGUOUS UNITED STATES, 1981 - 1990 (JULY 1981)

Figure 1.1-3. Electric regions in the western United States, June 1, 1981.



Legend
8 MSU Gulf
21 Missouri – Kansas Group
22 Oklahoma Group
23 Texas Interconnected Systems Group (TIS)
24 Rocky Mountain Power Area (RMPA)
26 Arizona – New Mexico Group
SOURCE DOE/ET 0022 ELECTRIC POWER SUPPLY DEMAND FOR CONTIGUOUS UNITED STATES 1981 1990 (JULY 1981)

Figure 1.1-1. Electric regions in the southwestern United States, June 1, 1981.

Table 1.1-2. Electrical peak demands (MW) and reserve margins (MW and percent); regions 25,27 and 28 (Nevada/Utah).

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Actual Reserves (MW)									
Regions 27 and 28 (Summer)[1]	10,201	12,170	11,827	11,384	10,936	10,149	9,741	8,463	8,511
Region 25 (Winter)[2]	1,910	4,035	2,579	2,335	6,377	9,157	8,983	8,177	8,558
Peak Demand									
Regions 27 and 28 (Summer)[3]	38,166	38,749	39,872	41,020	42,067	43,264	44,639	46,114	47,407
Region 25 (Winter)[4]	35,694	37,293	38,858	40,254	41,634	43,063	44,602	46,185	46,221
Actual Reserves (Percent)[5]									
Regions 27 and 28	26.7	31.4	29.7	27.8	26.0	23.5	21.8	18.4	18.0
Region 25	5.4	10.8	6.6	5.8	15.3	21.3	20.1	17.7	18.5

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[1]Reserves lowest in summer
[2]Reserves lowest in winter
[3]Demand highest in summer
[4]Demand highest in winter
[5]$\frac{\text{Actual Reserves}}{\text{Peak Demand}} \times 100\%$

Source: "Coordinated Bulk Power Supply Program, 1980-1990"-(DOE/ERA-411) Western Systems Coordinating Council (April 1, 1981).

Table 1.1-3. Oklahoma Group (Region 22) peak demand reserve margin (Texas/New Mexico).

Year	1982	1983	1984	1985	1986	1987	1988	1989	1990
Region 22									
Actual Reserves (MW)[1]									
Summer[3]	4,486	4,143	3,972	5,380	5,257	4,723	4,573	4,163	3,738
Peak Demand (MW)[1]									
Summer[4]	14,687	15,621	15,845	16,416	17,004	17,615	18,261	18,889	19,500
Actual Reserves (percent)[2]									
Summer	30.5	27.1	25.1	32.8	30.9	26.8	25.0	22.0	19.2

T4996/9-19-81

[1] DOE/ERA-411 "Regional Reliability Council Coordianted Bulk Power Supply Program," Southwest Power Pool (April 1, 1981).

[2] $\frac{\text{Actual Reserves}}{\text{Peak Demand}} \times 100\%$

[3] Reserves are lowest in summer.

[4] Demand is highest in summer.

Table 1.1-4. Existing electric generating units by state, company, plant, and county (Page 1 of 3).

State Company Plant County	Unit Number	Nameplate Rating (MW)	Unit Type	Primary Fuel	Alternative Fuel	Status	Date	Jointly Owned	Last Update
Arizona									
Arizona Power Authority									
Cholla									
Navajo	1	120.0	ST	BIT	None	Existing	1962	No	Jun 78
	2	263.0	ST	BIT	None	Existing	1978	No	Jun 78
	3	289.0	ST	BIT	None	Existing	1980	No	Nov 80
Coronado									
Apache	1	395.0	ST	BIT	FO2	Existing	1979	Yes	Mar 80
	2	350.0	ST	BIT	FO2	Existing	1980	Yes	Dec 80
Water and Power Resources Service									
Glen Canyon									
Coconino	1	119.0	HY	Water	None	Existing	1964	No	Sep 76
	2	119.0	HY	Water	None	Existing	1964	No	Sep 76
	3	119.0	HY	Water	None	Existing	1964	No	Sep 76
	4	119.0	HY	Water	None	Existing	1964	No	Sep 76
	5	119.0	HY	Water	None	Existing	1964	No	Sep 76
	6	119.0	HY	Water	None	Existing	1964	No	Sep 76
	7	119.0	HY	Water	None	Existing	1964	No	Sep 76
	8	119.0	HY	Water	None	Existing	1964	No	Sep 76

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Table 1.1-4. Existing electric generating units by state, company, plant, and county (Page 2 of 3).

State / Company / Plant / County	Unit Number	Nameplate Rating (MW)	Unit Type	Primary Fuel	Alternative Fuel	Status	Date	Jointly Owned	Last Update
Arizona (continued)									
Hoover									
Mohave	A1	83.0	HY	Water	None	Existing	1941	No	Jun 77
	A2	83.0	HY	Water	None	Existing	1942	No	Jun 77
	A3	83.0	HY	Water	None	Existing	1952	No	Jun 77
	A4	83.0	HY	Water	None	Existing	1952	No	Jun 77
	A5	83.0	HY	Water	None	Existing	1943	No	Jun 77
	A6	83.0	HY	Water	None	Existing	1939	No	Jun 77
	A7	83.0	HY	Water	None	Existing	1939	No	Jun 77
	A8	40.0	HY	Water	None	Existing	1937	No	Jun 77
	A9	50.0	HY	Water	None	Existing	1952	No	Jun 77
Nevada									
Nevada Power Company									
Gardner, Reid									
Clark	1	114.0	ST	BIT	None	Existing	1965	No	Jun 78
	2	114.0	ST	BIT	None	Existing	1968	No	Jun 78
	3	114.0	ST	BIT	FO2	Existing	1976	No	Jun 78

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Table 1.1-4. Existing electric generating units by state, company, plant, and county (Page 3 of 3).

State / Company / Plant / County	Unit Number	Nameplate Rating (MW)	Unit Type	Primary Fuel	Alternative Fuel	Status	Date	Jointly Owned	Last Update
Nevada (continued)									
Water and Power Resources Service									
Hoover									
Clark	N1	83.0	HY	Water	None	Existing	1936	No	Jun 77
	N2	83.0	HY	Water	None	Existing	1936	No	Jun 77
	N3	83.0	HY	Water	None	Existing	1937	No	Jun 77
	N4	83.0	HY	Water	None	Existing	1936	No	Jun 77
	N5	83.0	HY	Water	None	Existing	1938	No	Jun 77
	N6	83.0	HY	Water	None	Existing	1938	No	Jun 77
	N7	83.0	HY	Water	None	Existing	1944	No	Jun 77
	N8	95.0	HY	Water	None	Existing	1961	No	Jun 77
Utah									
Utah Power & Light Company									
Hunter (Emery)									
Emergy	1	400.0	ST	BIT	None	Existing	1978	No	Jan 79
	2	400.0	ST	BIT	None	Existing	1980	No	Nov 80
Water and Power Resources Service									
Flaming Gorge									
Unitah	1	36.0	HY	Water	None	Existing	1963	No	Jan 76
	2	36.0	HY	Water	None	Existing	1963	No	Oct 76
	3	36.0	HY	Water	None	Existing	1963	No	Oct 74

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Sources: DOE/EIA-0095(80) Energy Data Report, "Inventory of Power Plants in the United States - 1980 Annual" (June 18, 1981); DOE/RG-0047, "Proposed Changes to Generating Capacity for the Contiguous United States" (December 1980); Western Systems Coordinating Council, "Coordinated Bulk Power Supply Program 1980-1990 (April 1, 1981); DOE/EIA-0057, "Plant and Ownership List" (June 1978); Nevada Department of Energy, "Energy in Nevada" (May 1980), p. 44.

Notes: Steam turbine - non-nuclear (ST), Hydro (HY), Bituminous Coal (BIT), No. 2 Fuel Oil (FO2).

Table 1.1-5. Existing electric generating units by state, company, plant, and county.[1] (Texas/New Mexico)

STATE Company Plant County	Unit Number	Nameplate Rating (MW)	Unit Type	Primary Fuel	Alternative Fuel	Status	Date	Jointly owned	Last Update
TEXAS									
Southwestern Public Service Co.									
Harrington	1	360.0	ST	BIT	NG	Existing	1976	No	Jun 78
Potter	2	343.0	ST	BIT	NG	Existing	1978	No	Oct 78
	3	360.0	ST	BIT	NG	Existing	1980	No	Nov 80
Nichols									
Potter	1	113.6	ST	NG	None	Existing	1960	No	Jun 78
	2	113.6	ST	NG	None	Existing	1962	No	Jun 78
	3	247.5	ST	NG	None	Existing	1968	No	Jun 78

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[1] DOE/EIA-0095(80) "Energy Data Report"-"Inventory of Power Plants in the United States - 1980 Annual" (June 18, 1981).

Notes: Steam Turbine - non-nuclear (ST)
Bituminous Coal (BIT)
Natural Gas (NG)

Table 1.1-6. Projected electric generating units by state, company, plant, and county[1,2] (Page 1 of 4).

STATE Company Plant County	Unit Number	Scheduled Completion Current/ Original	Nameplate Rating (Mw)	Unit Type	Primary Fuel	EIS Status	Primary Component Order/ Delivery	Delay Cause/ Effect	Construct. Start
ARIZONA									
Arizona Public Service Co.[1,2,3,4]									
Cholla									
Navajo	4	May 81/ Jun 79	347	ST	BIT		Jul 74/ Dec 77	J/A	Sep 75
	5	May 87/ Jun 83	347	ST	BIT		Dec 76/ May 81	J/A	Jul 76
Bureau of Reclamation									
Hoover									
Mohave	1	92	500	HY	Water				
Palo Verde[1,2,3,4]									
Maricopa	1	May 83/ Jul 81	1270	NP	Uran	F/NRC	Oct 73/ Oct 78	Z/A	Jul 76
	2	May 84/ Jul 82	1270	NP	Uran	F/NRC	Oct 73/ Feb 80		Jul 76
	3	May 86 Jul 84	1270	NP	Uran	F/NRC	Oct 73/ Feb 81		Jul 76
Salt River Proj Agri Imp Pwr Dist[2,4]									
Coronado									
Apache	3	May 89/ May 82	350	ST	BIT	F/USBR		J/A	Jan 75
Bureau of Reclamation									
Glen Canyon									
Coconino	9	Dec 88	125	HY	Water				
	10	Dec 88	125	HY	Water				

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Table 1.1-6. Projected electric generating units by state, company, plant, and county[1,2] (Page 2 of 4).

STATE Company Plant County	Unit Number	Scheduled Completion Current/ Original	Nameplate Rating (Mw)	Unit Type	Primary Fuel	EIS Status	Primary Component Order/ Delivery	Delay Cause/ Effect	Construct. Start
NEVADA									
Nevada Power Company									
Henry Allen									
Clark	1	Oct 86/ Jun 79	500	ST	Coal				
	2	Oct 87/ Jun 80	500	ST	Coal				
	3	Oct 88/ Jun 81	500	ST	Coal				
	4	Oct 89/ Jun 82	500	ST	Coal				
Gardner, Reid[1,2,3,4,5,6]									
Clark	4	Jun 83/ Apr 83	250	ST	BIT				
White Pine[1,2,3,4]									
White Pine	1	Jun 89/	500	ST	BIT				
	2	Jun 90/	500	ST	BIT				
Sierra Pacific Power Company[1,2,3,4,6]									
North Valmy									
Humboldt	1	Oct 81/ Sep 81	250	ST	BIT	D/BLM	Feb 76/ Aug 78		Jun 78
	2	Oct 84/ Sep 82	250	ST	BIT	D/BLM		E	
Bureau of Reclamation									
Hoover									
Clark	1	88	450	HY	Water				

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Table 1.1-6. Projected electric generating units by state, company, plant, and county[1,2] (Page 3 of 4).

STATE Company Plant County	Unit Number	Scheduled Completion Current/ Original	Nameplate Rating (Mw)	Unit Type	Primary Fuel	EIS Status	Primary Component Order/ Delivery	Delay Cause/ Effect	Construct. Start
UTAH									
Los Angeles Dept of Water and Power[1,2,3,4,5,7]									
Intermountain									
Millard	1	Jun 86/ Nov 83	750	ST	BIT	P/BLM		E/E	81
	2	Jun 87/ Nov 84	750	ST	BIT	P/BLM		E/E	81
	3	Jun 88/ Nov 85	750	ST	BIT	P/BLM		E/E	81
	4	Jul 89	750	ST	BIT				
Nevada Power Company[1,2,3,4,5,7]									
Warner Valley									
Washington	1	Oct 85/ Jun 78	250	ST	BIT	P/BLM		H/E	
	2	Oct 88/ Jun 79	250	ST	BIT	B/BLM		H/E	
Utah Power & Light Company[1,2,3,4,5,7]									
Hunter (Emery)									
Emery	3	Jun 83/ Apr 83	400	ST	BIT	D/BLM			
	4	Jun 85/ Apr 85	400	ST	BIT	D/BLM			
Wellington[2,3,4]									
Carbon	1	Jun 88/ Jun 82	500	ST	Coal				

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Table 1.1-6. Projected electric generating units by state, company, plant, and county[1,2] (Page 4 of 4).

STATE Company Plant County	Unit Number	Scheduled Completion Current/ Original	Nameplate Rating (Mw)	Unit Type	Primary Fuel	EIS Status	Primary Component Order/ Delivery	Delay Cause/ Effect	Construct. Start
UTAH (continued)									
Desert Generating & Transmission[4,5,7]									
Moonlake									
Uintah	1	Dec 84	400	ST	Coal				
Water and Power Resource Service[1]									
Flaming Gorge									
Uintah	1	Dec 82	UPRATE TO 55	HY	Water				
	2	Apr 83	UPRATE TO 55	HY	Water				
	3	Dec 83	UPRATE TO 55	HY	Water				

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Sources:

[1]DOE/RG-0047 "Proposed Changes to Generating Capacity for the Contiguous United States," (December 1980).

[2]Western Systems Coordinating Council – "Coordinated Bulk Power Supply Program 1980 – 1990, (April 1, 1981).

[3]Western Systems Coordinating Council – "Ten Year Coordinated Plan Summary 1981 – 1990," (May 1981).

[4]DOE/EP-0022 "Electric Power Supply and Demand for the Contiguous United States," (July 1981).

[5]DOE/EIA-0095(80) – "Inventory at Power Plants in the United States – 1980 Annual" (June 18, 1981).

[6]Nevada Dept. of Energy – "*Energy in Nevada*," (May 1980) p. 44.

[7]Utah Energy Office – "Utah Energy Developments 1981 – 1990," (June 1981), p. 120.

Notes: Steam turbine - non-nuclear (ST)
Hydro (HY)
Steam - Power Nuclear (NP)
Bituminous Coal (BIT)

Table 1.1-7. Projected electric generating units by state, company, plant, and county[1,2]

STATE Company Plant County	Unit Number	*Scheduled* Completion Current/ Original	Nameplate Rating (MW)	Unit Type	Primary Fuel	EIS Status	Primary Component Order/ Delivery	Delay Cause/ Effect	Construct. Start
TEXAS									
Southwestern Public Service Co.									
Tolk Station									
Lamb	1	Jun 82/ Jun 82	508	ST	Coal		77/		Aug 78
	2	Jun 85/ Jun 85	508	ST	Coal		77/		

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[1]DOE/EP-0022 "Electric Power Supply and Demand for the Contiguous United States," (July 1981).

[2]DOE/RG-0047 "Proposed Changes to Generating Capacity for the Contiguous United States," (Dec. 1980).

Note: Steam turbine - non-nuclear (ST)

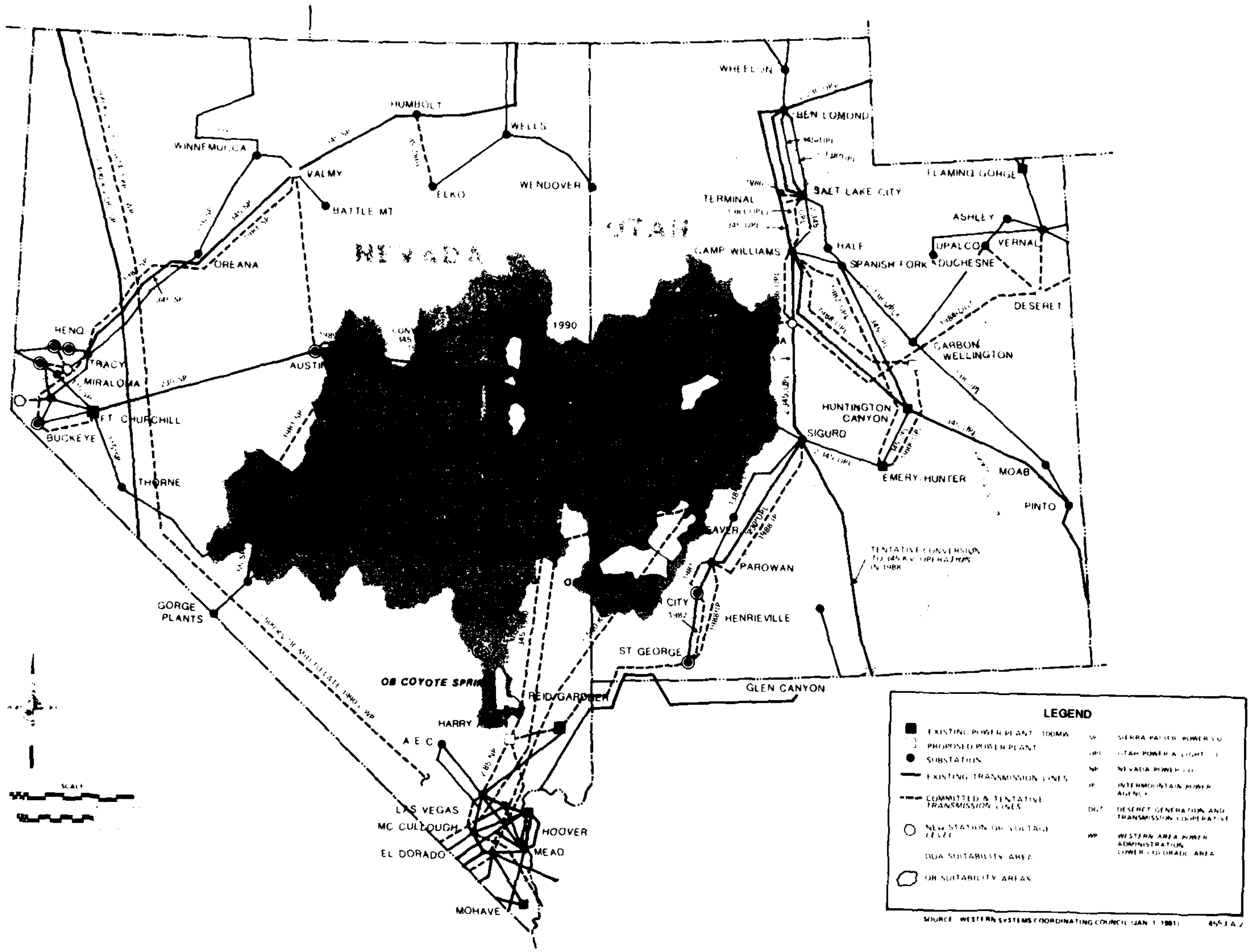

Figure 1.1-5. Existing and proposed transmission lines in Nevada/Utah.

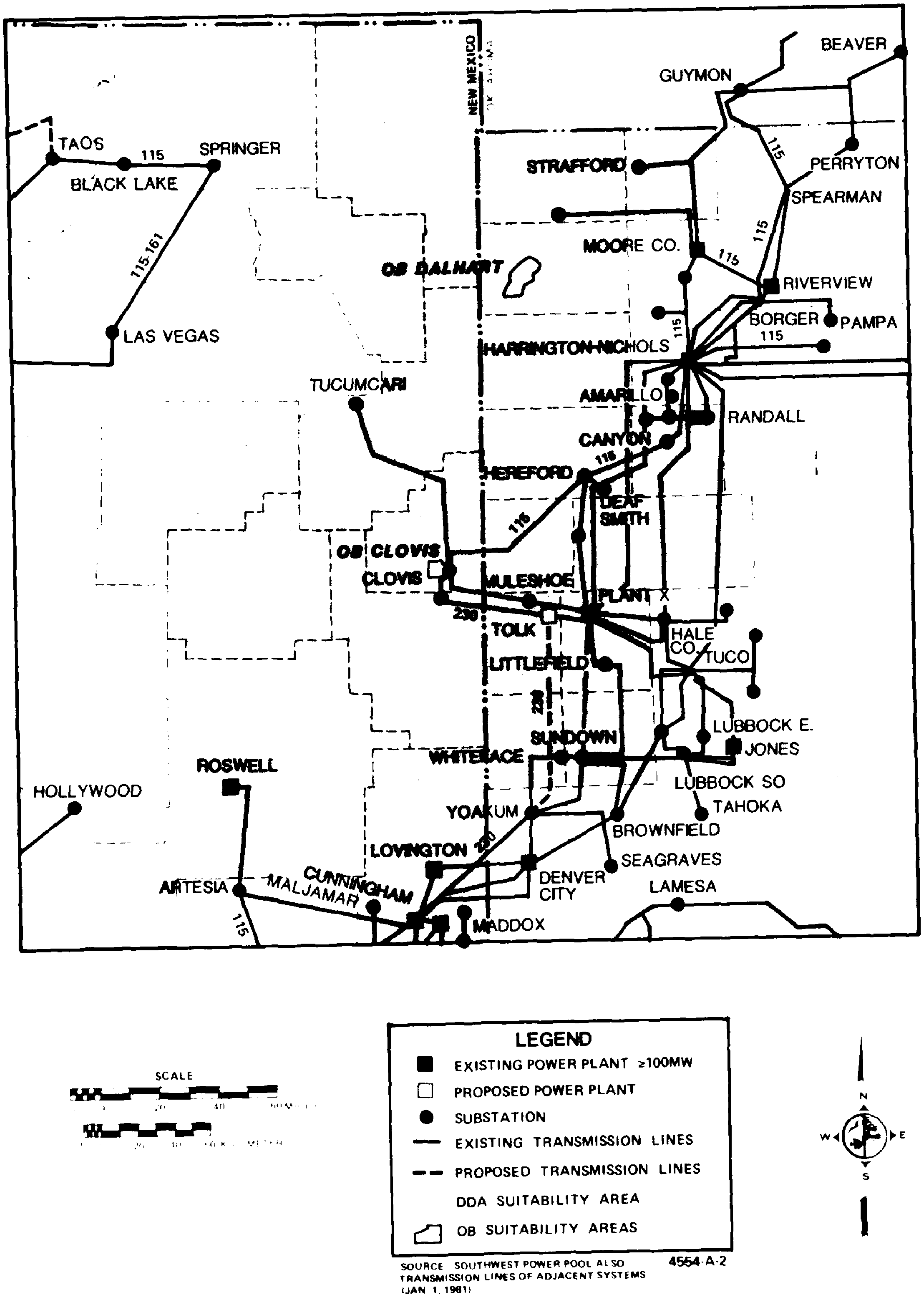

Figure 1.1-6. Existing and proposed high voltage lines in Texas/New Mexico.

Table 1.2-1. 1978 baseline consumption estimates of specific petroleum products, natural gas, and coal.

Product	U.S.[1]	Nevada[2]	Utah[2]	Texas[2]	New Mexico[2]
Total Petroleum (Thou bbls)	6,879,000	29,317	40,209	488,524	42,905
Motor Gasoline (Thou bbls)	2,705,000	11,698	17,478	201,991	18,922
Distillate Fuel Oil[3] (Thou bbls)	1,252,556	3,822	9,023	81,171	9,633
Jet Fuel (Thou bbls)	386,000	6,652	1,898	28,537	2,793
Natural Gas (dry) (mill. cu ft)	19,630,000	64,506	118,513	4,211,432	213,698
Coal (Thou short tons)	625,200	4,130	5,873	27,255	8,078

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[1]DOE/EIA-0173(80)/2, Vol. 2 (of 3), "1980 Annual Report to Congress" - Volume Two: Data (April 13, 1981).

[2]DOE/EIA-0214(78), "State Energy Data Report: 1960 through 1978" (April 1980), pp. 13, 247, 271, 367, 375.

[3]Distillate fule oils include all distillate heating and diesel oils.

Table 1.2-2. Projections of U.S. consumption of selected petroleum products, natural gas and coal to 1985, 1990 and 1995.

Product Units	History 1978	Projections 1985 Low	1985 Mid	1985 High	1990 Low	1990 Mid	1990 High	1995 Low	1995 Mid	1995 High
Total Petroleum (mill bbls/day)	18.85	15.8	15.2	14.7	16.4	15.4	14.6	17.0	14.6	13.2
Index (1978=100.0)	100.0	83.8	80.6	78.0	87.0	81.7	77.5	90.2	77.5	70.0
Motor Gasoline (mill bbls/day)	7.41	6.2	6.0	5.7	6.0	5.5	5.2	6.1	5.2	4.6
Index (1978=100.0)	100.0	83.7	81.0	76.9	81.0	74.2	70.2	82.3	70.2	62.1
Distillate Fuel Oil (mill bbls/day)	3.43	2.9	2.9	2.8	3.1	3.0	2.9	3.5	3.1	2.9
Index (1978=100.0)	100.0	84.5	84.5	81.6	90.4	87.5	84.5	102.0	90.4	84.5
Jet Fuel (mill bbls/day)	1.06	1.0	1.0	0.9	1.2	1.1	1.0	1.5	1.1	0.9
Index (1978=100.0)	100.0	94.3	94.3	84.9	113.2	100	94.3	141.5	100	84.9
Natural Gas[1] (trill cu ft/yr.)	19.63		18.1			17.4			17.0	
Index (1978=100.0)	100.0		92.2			88.6			86.6	
Coal[1] (mill tons/yr.)	625.2	948	947	949	1324	1324	1336	1702	1757	1767
Index (1978=100)	100.0	151.6	151.5	151.8	211.8	211.8	213.7	272.2	281.0	282.6

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[1] Annual consumption was averaged over 365 days.

Source: DOE/EIA-0173(80)/3, Annual Report to Congress, 1980, Vol. 3 of 3.

Table 1.2-3. Annual fuel consumption projections - United States.

Fuel	History 1978	Projections[3] 1985 Low	1985 Mid	1985 High	1990 Low	1990 Mid	1990 High	1995 Low	1995 Mid	1995 High
Total Petroleum (10^3 BBLS)[1]	6,879,000[1]	5,767,000	5,548,000	5,365,000	5,986,000	5,621,000	5,329,000	6,205,000	5,329,000	4,818,000
Natural Gas (Dry) (10^6 ft^3)	19,630,000[1]		18,100,000			17,400,000			17,000,000	
Total Distillate Fuel Oils (10^3 BBLS)	1,253,000[1]	1,058,500	1,058,500	1,022,000	1,131,500	1,095,000	1,058,500	1,277,500	1,131,500	1,058,500
Total Diesel Fuel (10^3 BBLS)	360,800[2]	304,900	304,900	294,400	326,200	315,700	304,900	368,000	326,200	304,900
Total #2 Heating Fuel (10^3 BBLS)	469,200[2]	396,500	396,500	382,900	424,400	410,600	396,500	478,600	424,200	396,500
Gasoline (10^3 BBLS)	2,705,000[1]	2,263,000	2,190,000	2,080,500	2,190,000	2,007,500	1,898,000	2,226,500	1,898,000	1,679,000
Jet Fuel (10^3 BBLS)	386,000[1]	365,000	365,000	328,500	438,000	401,500	365,000	547,500	401,500	328,500
Coal (10^3 short tons)	625,200[1]	948,000	947,000	949,000	1,324,000	1,324,000	1,336,000	1,702,000	1,757,000	1,767,000

T5175/9-16-81/F

Sources: [1]DOE/EIA-0173(80)/2, Vol. 2 (of 3), "1980 Annual Report to Congress" -- Volume Two: Data (April 13, 1981).

[2]DOE/EIA-0113(78), Energy Data Reports, Fuel Oil Sales, Annual (Nov. 6, 1979).

[3]ETR-24, Table 1.2-2 (Daily consumption x 365 days/year).

Note: Total distillate fuel oils include all distallate heating and diesel oils.

Table 1.2-4. Petroleum products, natural gas and coal consumption forecast for Nevada, Utah, Texas and New Mexico (1985, 1990 and 1995) (Page 1 of 2).

Product Units	History 1978	Projections 1985 Low	1985 Mid	1985 High	1990 Low	1990 Mid	1990 High	1995 Low	1995 Mid	1995 High
Total Petroleum (Thou bbls)										
Nevada	29,317	24,568	23,630	22,867	25,506	23,952	22,721	26,444	22,721	20,522
Utah	40,209	33,695	32,408	31,363	34,982	32,851	31,162	36,269	31,162	28,146
Texas	488,524	409,383	393,750	381,049	425,016	399,124	378,606	440,649	378,606	341,967
New Mexico	42,905	35,954	34,581	33,466	37,327	35,053	33,251	38,700	33,251	30,034
Motor Gasoline (Thou bbls)										
Nevada	11,698	9,791	9,475	8,996	9,475	8,580	8,212	9,627	8,212	7,264
Utah	17,748	14,629	14,157	13,441	14,157	12,969	12,270	14,384	12,270	10,854
Texas	201,991	166,066	163,613	155,331	163,613	149,877	141,798	166,239	141,798	125,436
New Mexico	18,922	15,838	15,327	14,551	15,327	14,040	13,283	15,573	13,283	11,751
Distillate Fuel Oil[2] (Thou bbls)										
Nevada	3,822	3,230	3,230	3,119	3,455	3,344	3,230	3,898	3,455	3,230
Utah	9,023	7,624	7,624	7,363	8,157	7,895	7,624	9,203	8,157	7,624
Texas	81,171	68,589	68,589	66,236	73,379	71,024	68,589	82,794	73,379	68,589
New Mexico	9,633	8,140	8,140	7,861	8,708	8,429	8,140	9,826	8,708	8,140
Jet Fuel (Thou bbls)										
Nevada	6,652	6,273	6,273	5,621	7,530	6,652	6,273	9,413	6,652	5,648
Utah	1,898	1,790	1,790	1,611	2,149	1,898	1,790	2,686	1,898	1,611
Texas	28,537	26,910	26,910	24,228	32,304	28,537	25,910	40,380	28,537	24,228
New Mexico	2,793	2,634	2,634	2,371	3,162	2,793	2,634	3,952	2,793	2,371

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Table 1.2-4. Petroleum products, natural gas and coal consumption ... ~ast for Nevada, Utah, Texas and New Mexico (1985, 1990 and 1995) (Page 2 of 2).

Product Units	History 1978	Projections 1985 Low	1985 Mid	1985 High	1990 Low	1990 Mid	1990 High	1995 Low	1995 Mid	1995 High
Natural Gas (dry) (mill it^3)										
Nevada	64,506		59,475			57,152			55,862	
Utah	118,513		109,269			105,003			102,632	
Texas	4,211,432		3,882,940			3,731,329			3,647,100	
New Mexico	213,698		197,030			189,336			185,062	
Coal (Thou short tons)										
Nevada	4,130	6,261	6,257	6,269	8,747	8,747	8,830	11,242	11,605	11,671
Utah	5,873	8,903	8,898	8,915	12,439	12,439	12,551	15,986	16,503	16,597
Texas	27,355	41,318	41,291	41,373	57,726	57,726	58,744	74,188	76,587	77,023
New Mexico	8,078	12,246	12,238	12,262	17,109	17,109	17,263	21,988	22,699	22,828

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[1]Projections indicate amount of conservation measures applied (low, mid, high).

[2]Distillate fuel oils include all distillate heating and diesel oils.

Sources: History - ETR-24, Table 1.2-1; Projections - ETR-24, Tables 1.2-1 and 1.2-2 (Consumption X Index).

In the low price case, the cost of imported crude oil is assumed to rise at the same rate as the GNP deflator. In the medium price case, the price of imported crude oil is assumed to rise at the rate of inflation, and in the high price case, the price of crude oil is assumed to rise at three times the rate of inflation.

Although none of the cases should be regarded as the single "best" estimate of future occurrences, the range of cases given is believed to encompass the most likely developments.

Beyond 1985, low coal prices - relative to gas prices - and federal regulations restricting the use of natural gas by industry and electric utilities result in relatively stable gas prices across both time and scenarios and only the midrange projections are presented.

Baseline data for 1978 and projected 1985, 1990, and 1995 estimates of consumption forecast for Nevada, Utah, Texas, and New Mexico are presented in Tables 1.2-1 through 1.2-4.

1.3 NATURAL GAS -- GASEOUS FUELS

The gaseous fuels required for the M-X system and support communities would be natural gas and propane. Baseline consumption data for 1978 and projected 1985, 1990, and 1995 estimates of consumption of gaseous fuels are presented for the United States in Tables 1.2-1, 1.2-2, and 1.2-3.

Similar to petroleum, DOE/EIA energy market projections were carried out for natural gas consumption, as reflected in the tables listed above. However, for natural gas consumption, the DOE/EIA has elected to present only the middle price range.

Corresponding baseline data were developed for the individual states, assuming their natural gas consumption will move in consonance with overall national consumptions patterns. Baseline data for 1978 and projected 1985, 1990 and 1995 estimates of consumption forecast for Nevada, Utah, Texas, and New Mexico are presented in Tables 1.2-1 through 1.2-4.

The location, ownership, and size of existing and proposed natural gas pipelines were determined from detailed plan and profile drawings obtained from the various energy companies in the M-X region.

Plots of existing and proposed underground pipelines in the Nevada/Utah M-X region are shown on Figure 1.3-1. Similar plots for the Texas/New Mexico M-X region are shown on Figure 1.3-2.

1.4 COAL -- SOLID FUELS

The solid fuel required for the M-X system and support communities would be coal. Baseline data for 1978 and projected 1985, 1990, and 1995 estimates of consumption of solid fuels are presented in the United States, in Tables 1.2-1, 1.2-2, and 1.2-3.

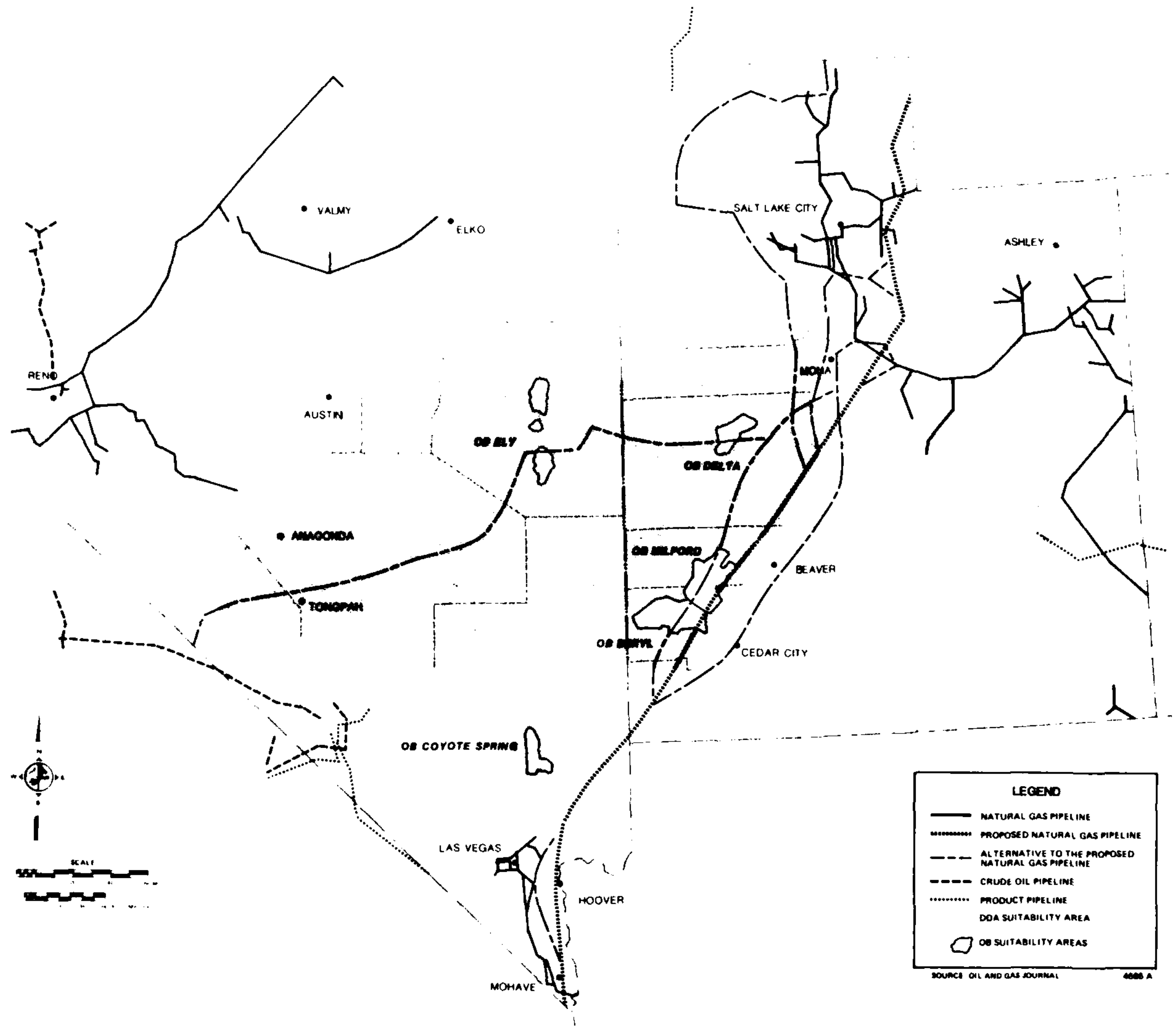
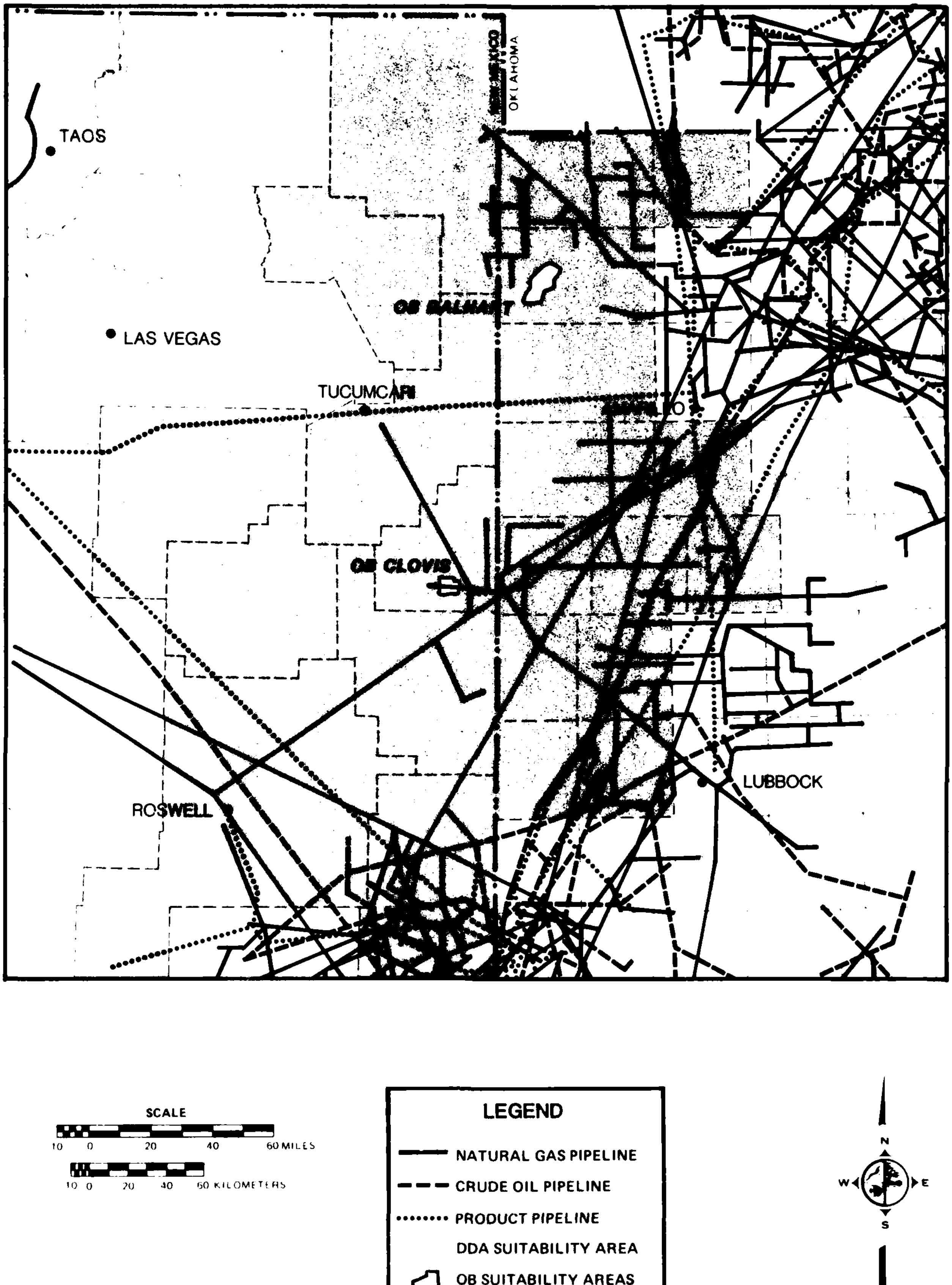


Figure 1.3-1. Existing and proposed pipelines in Nevada/Utah.



SOURCE: OIL AND GAS JOURNAL 4665-A

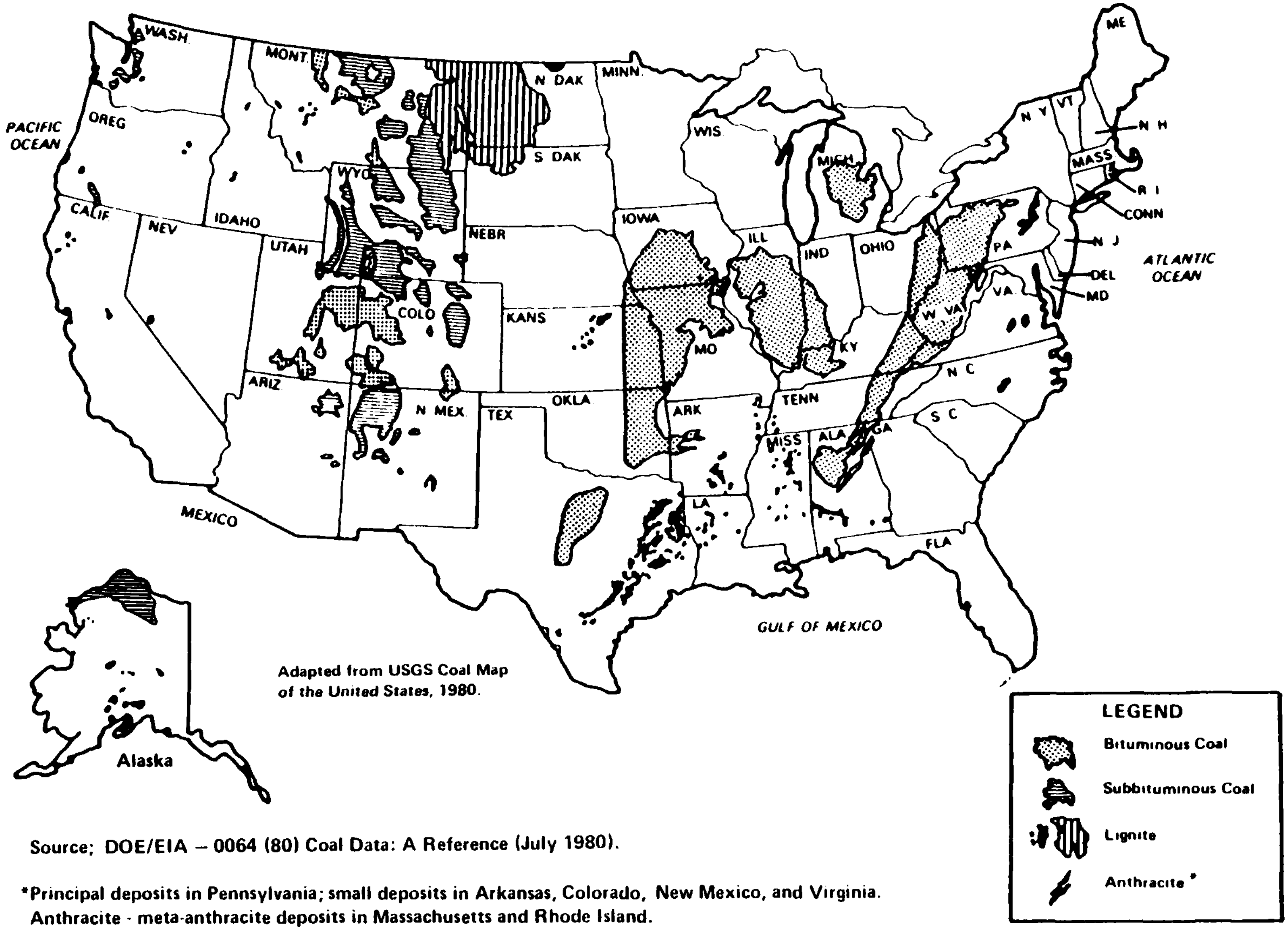
Figure 1.3-2. Existing and proposed pipelines in Texas/New Mexico.

Similar to petroleum, DOE/EIA energy market projections were carried out for coal consumption, as noted in the tables listed above.

Corresponding baseline data were developed for the individual states, assuming that their coal consumption will move at the same rate as overall coal consumption patterns. Baseline data for 1978 and projected 1985, 1990 and 1995 estimates of consumption forecast for Nevada, Utah, Texas, and New Mexico are presented in Tables 1.2-1 and 1.2-4.

Figure 1.4-1 shows the coal fields of the United States, Figure 1.4-2 shows the coal producing counties, while Figure 1.4-3 shows the demonstrated coal reserve base, January 1, 1976.

Figure 1.4-4 and 1.4-5 show energy resources in Nevada/Utah and Texas/New Mexico. For more detail see ETR-11 (Geology and Mining).

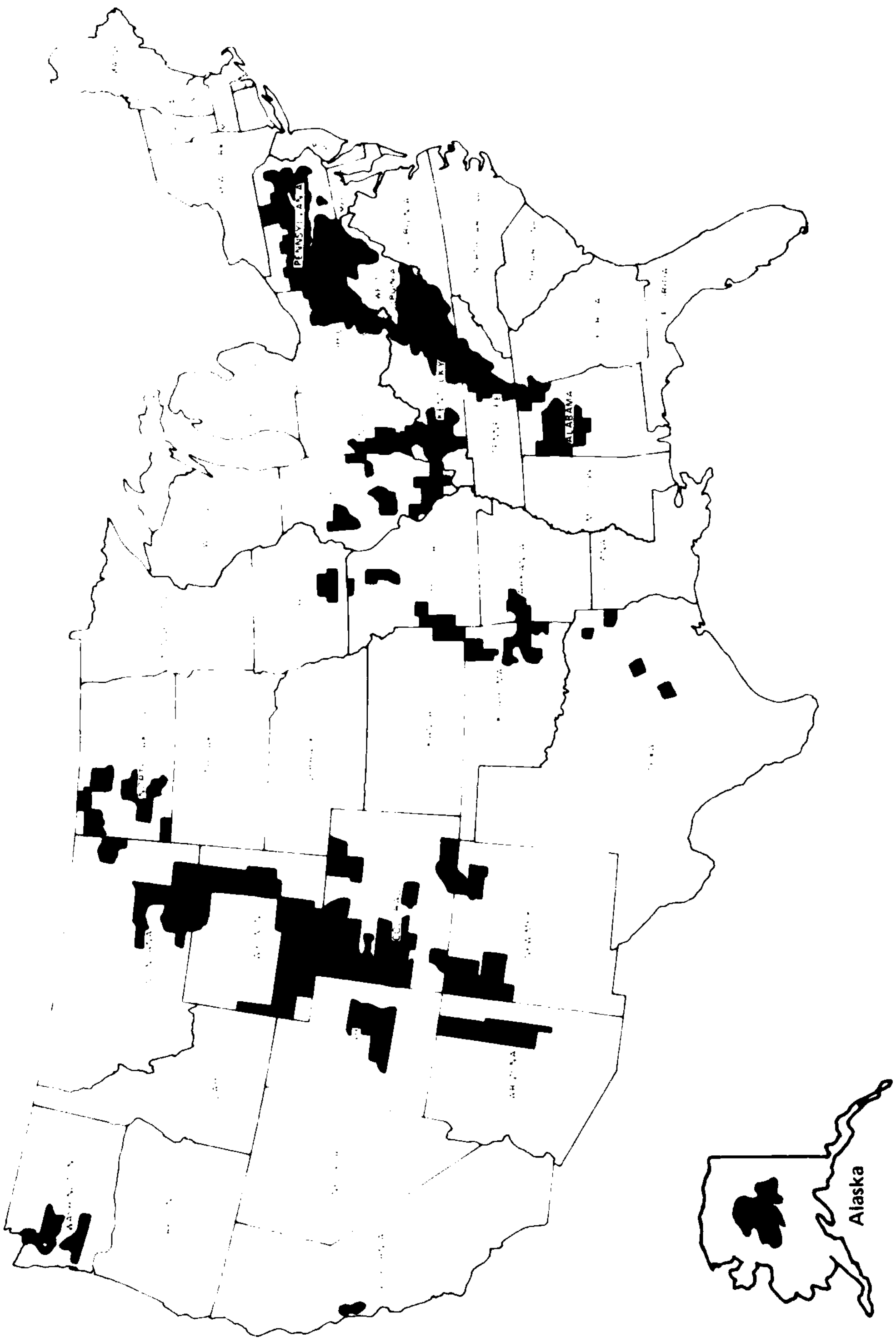


Source; DOE/EIA – 0064 (80) Coal Data: A Reference (July 1980).

*Principal deposits in Pennsylvania; small deposits in Arkansas, Colorado, New Mexico, and Virginia. Anthracite - meta-anthracite deposits in Massachusetts and Rhode Island.

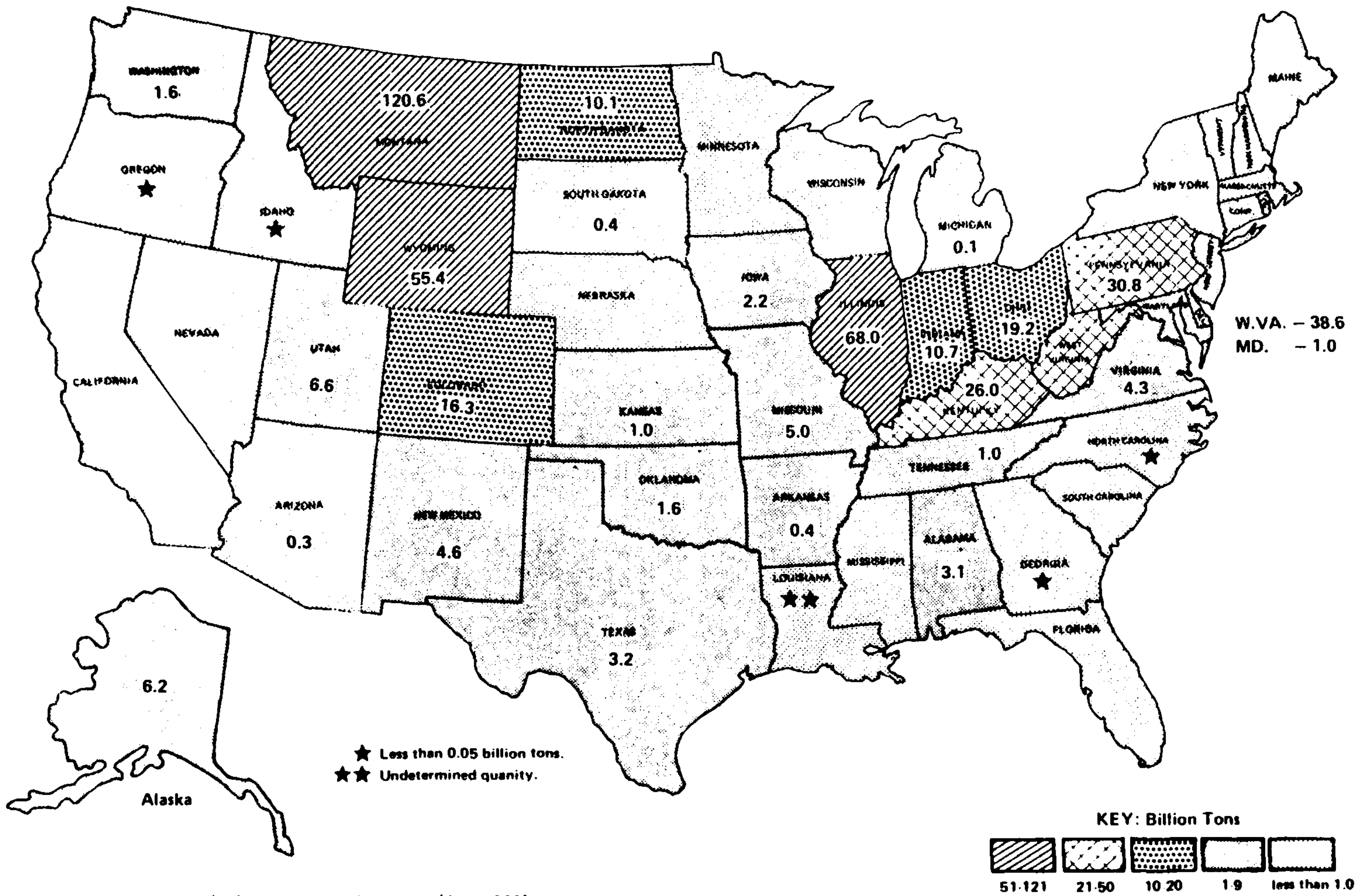
Figure 1.4-1. Coal fields of the United States.

4683-A



Source: DOE/EIA – 0064 (80) Coal Data: A Reference (July 1980).

Figure 1.4-2. Coal producing counties in the United States.



Source: DOE/EIA – 0064 (80) Coal Data: A Reference (July 1980).

Note: The recoverability ranges from 40 to 90 percent for individual deposits. 50 percent or more of the total demonstrated coal reserve base is estimated to be recoverable.

4682-A

Figure 1.4-3. Demonstra ed coal reserve base, January 1, 1976 (U.S. total: 438.3 billion tons).

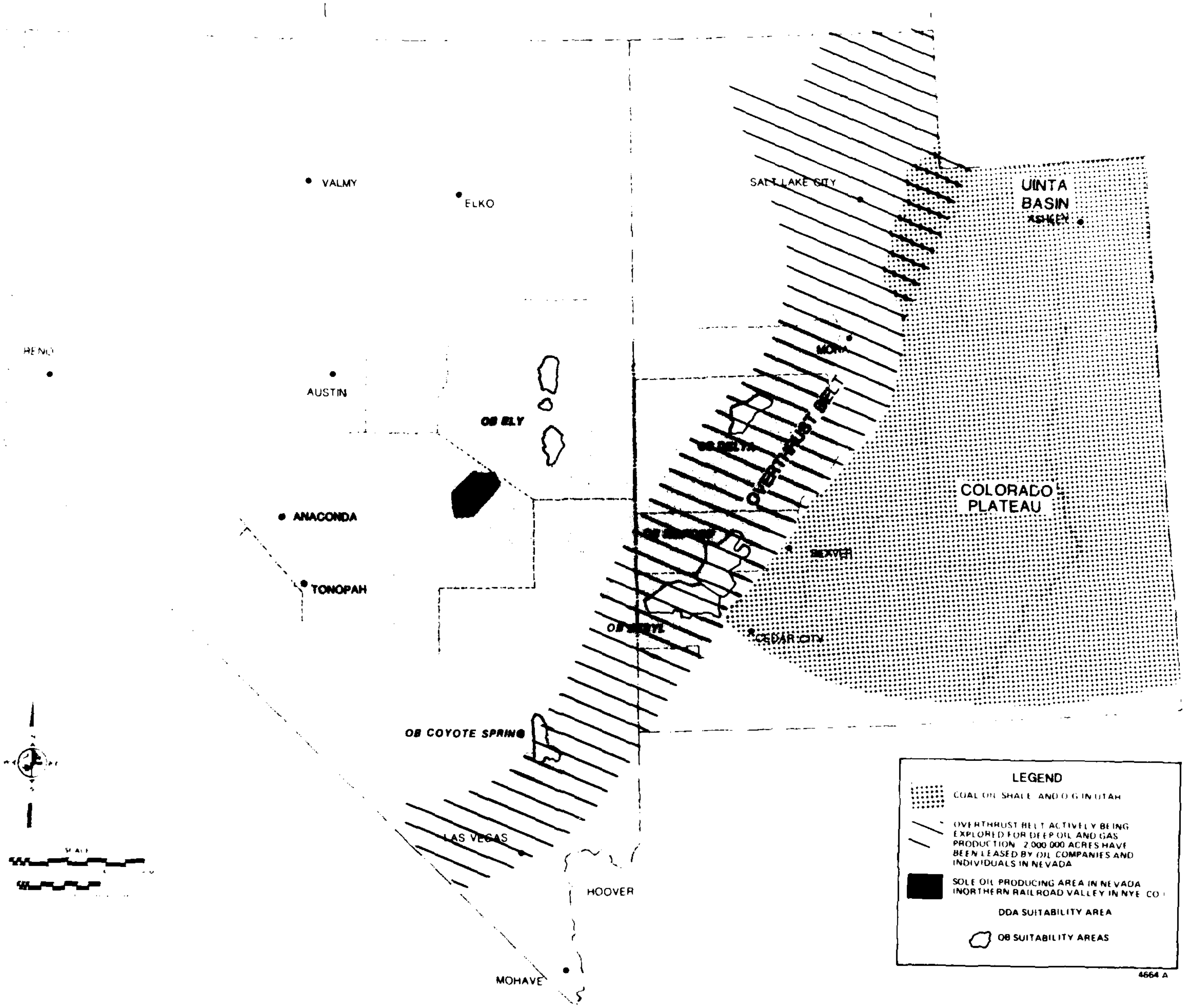


Figure 1.4-4. Energy resources in Nevada/Utah.

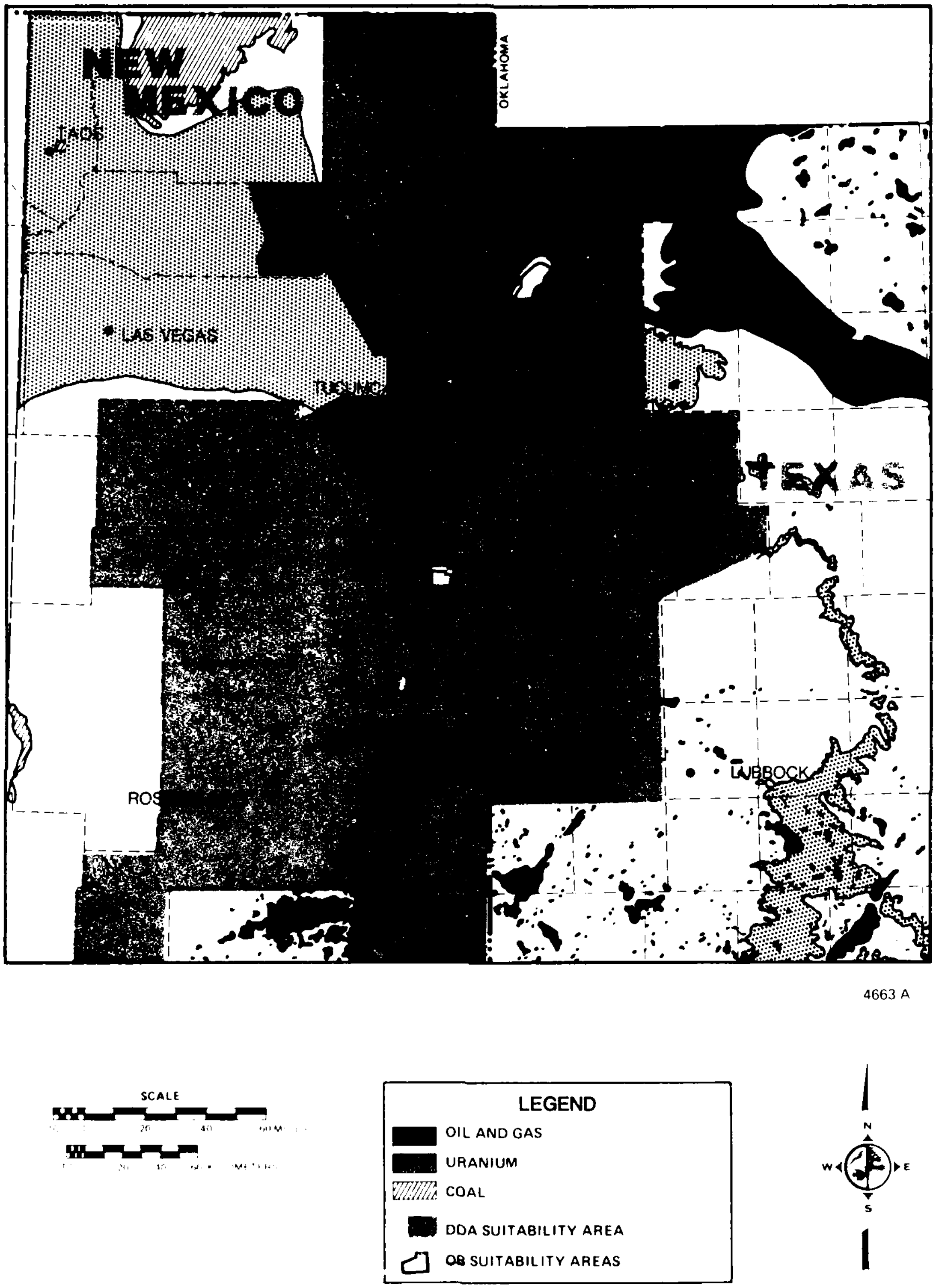


Figure 1.4-5. Energy resources in Texas/New Mexico.

2.0 DESCRIPTION OF THE M-X PROJECT ENERGY REQUIREMENTS

2.1 M-X SYSTEM ENERGY BREAKDOWN

The deployment of the M-X system will require additional regional expenditures of energy, electrical and fuels, for both direct and indirect purposes. During construction, energy will be required for activities such as construction camp facilities, personnel commuting and recreation, construction equipment operation, and community development for indirect workers who are brought to the area. During the operations phase, there will be an energy requirement for the maintenance and security of the system in the DDA and for the heating, ventilation, and air conditioning (HVAC) of the base facilities and off-base support housing, personnel commuting and recreation for the operating bases and surrounding communites. An M-X system energy breakdown diagram is presented in Figure 2.1-1.

2.2 SUMMARY OF ENERGY REQUIREMENTS BY ALTERNATIVE

Table 2.2-1 presents a summary of the annual energy requirements for the Proposed Action and alternatives for the peak construction and operation year (1986) and Table 2.2-2 for the operation phase (1992). Table 2.2-3 gives a summary of the total construction energy requirements by alternative for years 1982-1987. These figures include the DDA, operating bases, and support community energy consumptions.

For the construction and operation phase, the electrical demand is about 47 percent higher than operations phase demand, approximately 368 Mw (includes M-X secondary impacts). Gasoline consumption varies from about 70 million gallons per year for the construction and operation phase 1986, to about 40 million gallons per year for the operation phase 1992. Fuel oil consumption varies from 22 to 12 million gallons per year for the Nevada/Utah alternatives.

For the operations phase, the electrical demand and usage is essentially the same for all alternatives; approximately 250 Mw demand and 1200 Mwh per year (includes M-X secondary impacts). Gasoline consumption, based on the traffic modeling, varies from about 28 million gallons per year for Alternative 7 to 37 million gallons per year for the Proposed Action. Fuel oil consumption varies from a negligible amount for Alternative 7 because of availability of natural gas, to a range of 9 to 12 million gallons for the Nevada/Utah full basing alternatives, with 9 million gallons per year for the Proposed Action. Diesel and JP4 fuel consumption is shown to be about 39 million gallons per year for most alternatives. Information is not available at this time for further refinement.

2.3 ESTIMATING METHODOLOGY FOR FUEL AND ENERGY REQUIREMENTS

INTRODUCTION (2.3.1)

The energy requirements for deployment of the M-X system are defined in terms of maximum demand and annual energy consumption. Mechanical and electrical loads for the M-X facilities are tabulated separately for the various regions under consideration for deployment of the system. These are shown later.

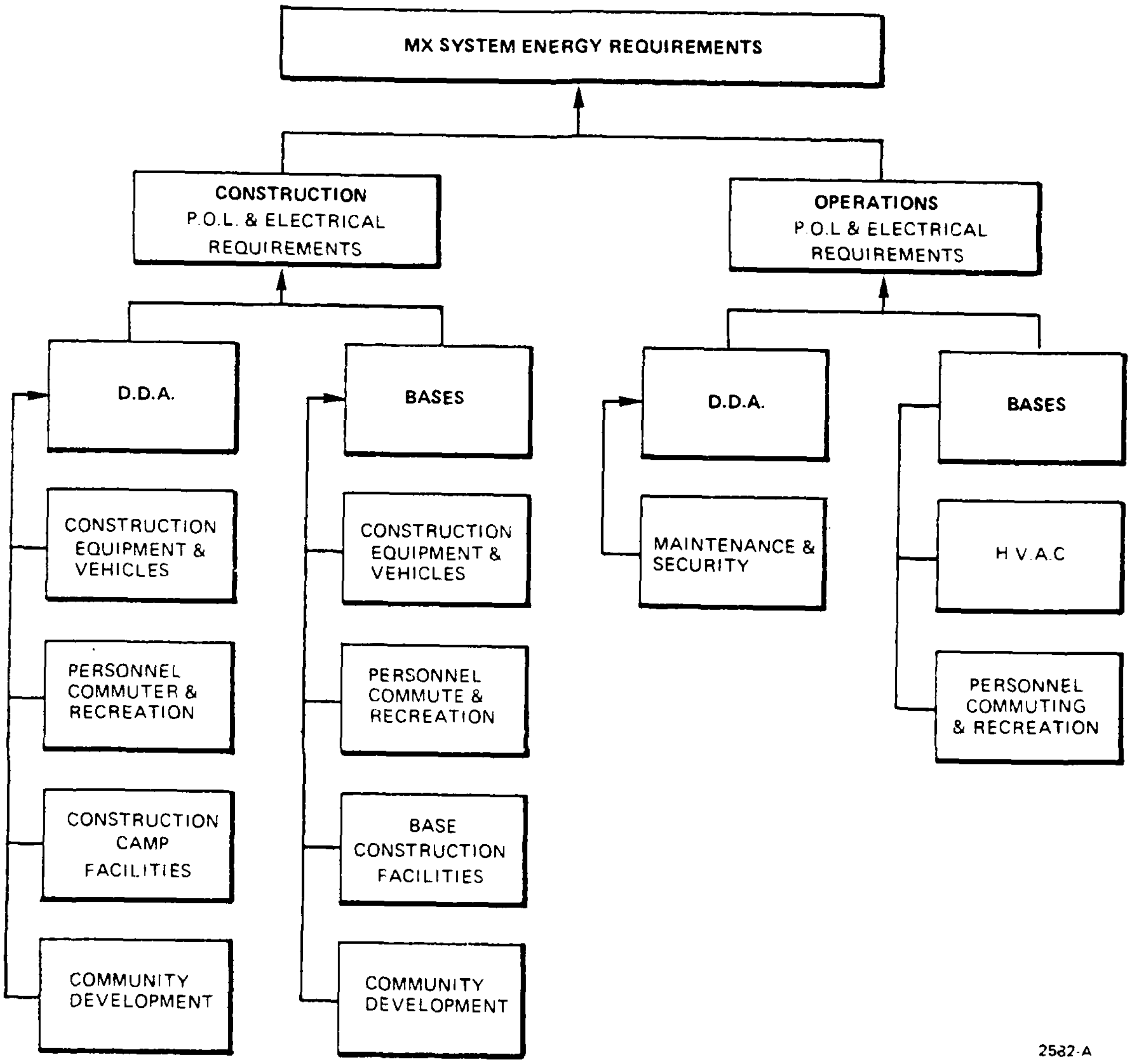


Figure 2.1-1. M-X system energy breakdown diagram.

Table 2.2-1. Summary of annual energy requirements for the Proposed Action and alternatives for the peak construction year (1986) and for the operation phase (1986).

	Construction (1986)						Operations (1986)					
	P.O.L.				Electrical		P.O.L.				Electrical	
Alternative	Gasoline 10^6 GA	Diesel 10^6 GA	Fuel Oil 10^6 GA	Natural Gas 10^6 CF	Demand MW	Total Use 10^3 MWH	Gasoline 10^6 GA	Diesel 10^6 GA	Fuel 10^6 GA	Natural Gas 10^6 CF	Demand MW	Total Use 10^3 MWH
P/A	61	53	10		177	685	7	15	6		182	795
1	60	53	11		177	682	7	15	6		182	798
2	62	53	11		178	686	7	15	6		180	792
3	55	53	14		214	836	6	15	8		154	692
4	55	53	12		194	752	7	15	8		159	714
5	59	53	15		217	849	7	15	7		148	670
6	64	53	12		198	767	7	15	7		153	691
7	38	41		847	140	551	4	15		655	145	668
8	35	45	7	509	187	731	7	18	7	11	184	762

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Notes:

Annual electrical usage shown excludes estimated electricity generated by standby diesel generators.

Annual diesel fuel quantities shown includes estimated diesel fuel required by the standby diesel generators and JP-4 fuel.

10^6 = million; 10^3 = thousand.

P.O.L. = petroleum oil and lubricants.

Includes M-X induced loads without energy conservation. Source:HDR Sciences, 1981.

Table 2.2-2. Summary of annual energy requirements for the Proposed Action and Alternatives for the operation phase (1992).

	Operations (1992)					
	P.O.L.				Electrical	
Alternative	Gasoline	Diesel	Fuel Oil	Natural Gas	Demand	Total Use
	10^6 Gal	10^6 Gal	10^6 Gal	10^6 CF	MW	10^3 MWh
P/A	37	39	9		234	1,115
1	36	39	9		234	1,107
2	39	39	9		230	1,095
3	34	39	12		235	1,126
4	35	39	9		235	1,116
5	35	39	12		241	1,129
6	36	39	9		235	1,119
7	28	39		1,104	241	1,161
8	33	60	4	509	251	1,168

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Notes: Annual electrical usage shown excludes estimated electricity generated by standby diesel generators.

Annual diesel fuel quantities shown includes estimated diesel fuel required by the standby diesel generators and JP-4 fuel.

10^6 = million; 10^3 = thousand.

P.O.L. = petroleum oil and lubricants.

Source: HDR Sciences.

Table 2.2-3. Summary of total energy requirements for construction, by alternative.

Alternative	Construction Totals				
	P.O.L.			Natural Gas	Electrical
	Gasoline 10^6 GA	Diesel 10^6 GA	Fuel Oil 10^6 GA	Total Use 10^6 CF	10^3 MWH
PA	228	199	48		3315
1	235	199	53		3300
2	292	199	53		3320
3	248	197	65		3870
4	259	199	58		3640
5	267	197	70		3930
6	302	199	58		3712
7	181	190	--	3964	2580
8	162	197	34	2450	3523

T4101/10-2-81

Source: HDR Sciences calculation.

Electrical data include normal lighting, convenience outlets, motors as required for the working environment, and equipment necessary for specific tasks. Energy data were developed for space heating, domestic water hea. ıg, and air conditioning loads for the respective facilities, all expressed in Btu. Applying appropriate efficiencies, heating values of the fuels and conversion factors, heating loads in Btu were converted to quantities of fuels, electricity and cooling loads to electric energy.

The energy requirements for the M-X system are based on the specific requirements for various components of the system and on applicable state energy codes and/or ASHRAE Standard 90-75. Energy used in buildings is based on climatic conditions at the site (temperature, humidity, wind, sun), building construction, occupancy, and the type of working environments and equipment required.

Seven sites are under consideration for base locations. It is assumed that population increases will occur in the county or counties in which the bases are located. Climatic conditions of the counties under consideration were used to determine the building envelope heat loss and heat gain. Domestic hot water usage is based on ASHRAE standards for design temperature and flow.

ESTIMATING METHODS FOR DETERMINING HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) REQUIREMENTS (2.3.2)

All the building types, sizes, and operating hours were taken from EDAW "M-X Base Comprehensive Plan" interim report 1, Deliverables 13 and 15 dated May 29, 1981. The HVAC load requirement was calculated by using (ASHRAE) degree day method, given building type and climatic conditions.

ESTIMATING METHODS FOR DETERMINING ELECTRICAL REQUIREMENTS (2.3.3)

Electrical operational requirements for the M-X system were derived from the "Power Systems Study Interim Report", dated April 17, 1980, and updated data by Boeing. Electrical requirements for all M-X support facilities were calculated based on appropriate conventional watts per square foot (Btu per hour per square foot), estimated occupancy, and hours of usage.

ESTIMATING METHODS FOR DETERMINING OFFBASE PERSONNEL HEATING FUEL AND ELECTRIC POWER REQUIREMENTS (2.3.4)

Additional heating fuel and electric power will be required in nearby communities due to the increase in civilian population to support the M-X system. Energy requirements for offbase housing units were calculated based on conventional estimating practices. Assuming that an average of 2.5 persons occupy each housing unit, per capita energy requirements were developed for each region as shown in Tables 2.3.4-1 and 2.3.4-2. Total offbase energy requirements for each fuel type were then calculated by multiplying each per capita energy value by projected off-base population increases for each alternative, considering the type of mechanical equipment used and their efficiencies. (See ETRs 2B-2L and 3B-3C)

M-X secondary impacts on electrical peak demand and annual consumption, annual heating oil consumption, and annual natural gas usage for counties and states are presented in Appendix C. The data in these tables represent only M-X-induced

Table 2.3.4-1 Energy demand for offbase civilian housing based on population increases due to M-X deployment.[1]

Location	Peak Demand Per Individual			
	Electric[4] kW	Heating Btu/hr	Cooling Btu/hr	Hot Water Btu/hr
Nevada				
White Pine County				
Ely	0.6	15,100	8,550	4,055
Clark County				
Coyote/Kane Springs	0.6	11,400	9,450	4,055
Utah				
Iron County				
Beryl	0.6	13,700	8,750	4,055
Beaver County				
Milford	0.6	13,700	8,900	4,055
Millard County				
Delta	0.6	14,700	8,950	4,055
Texas[2]				
Dalhart	0.65	13,500	8,950	4,055
New Mexico[3]				
Clovis	0.65	13,100	8,850	4,055

T3187/9-17-81

[1] The energy requirements are based on "per individual-per hour". An average occupancy of 2.5 persons per home is assumed.

[2] Typical for all counties in Texas.

[3] Typical for all counties in New Mexico.

[4] Does not include cooling.

Source: HDR Sciences.

Table 2.3.4-2. Annual energy usage for offbase civilian housing based on population increases due to M-X development.

	Annual Usage Per Individual			
	Electric[4] kWh	Heating $x10^6$ Btu	Cooling $x10^6$ Btu	Hot Water $x10^6$ Btu
Nevada				
White Pine County				
Ely	4,080	37.3	4.7	10.3
Clark County				
Coyote/Kane Springs	4,080	19.5	18	10.3
Utah				
Iron County				
Beryl	4,080	30	10	10.3
Beaver County				
Milford	4,080	31.4	9.2	10.3
Millard County				
Delta	4,080	31	9.6	10.3
Texas[2]				
Dalhart	3,840	20	19.6	10.3
New Mexico[3]				
Clovis	3,750	21.5	18.3	10.3

T3186/9-17-81

[1]The average requirements are based on "per individual-per year". An average occupancy of 2.5 persons per home is assumed.

[2]Typical for all counties in Texas.

[3]Typical for all counties in New Mexico.

[4]Does not include cooling.

Source: HDR Sciences.

impacts and do not include usage of the DDA, operating bases, DAA, OBTS or construction camps.

2.4 DESIGNATED DEPLOYMENT AREA (DDA): ENERGY REQUIREMENTS

DDA CONSTRUCTION: ENERGY REQUIREMENTS (2.4.1)

During the construction phase, most of the energy requirements will be in the form of petroleum, oil, and lubricants (P.O.L.) to operate the construction equip ment, concrete batch plants, generators, and vehicles required for this phase.

The induced growth in the construction site area will create support communities. These communities will require between about 110 and 192 Mw of electric demand, depending on the alternative.

There will be up to 18 construction camps located throughout the deployment area. The camps will be approximately 30 mi apart and will employ 1,300 to 2,300 construction workers. Each camp will be in operation for approximately four years.

Each construction camp will be a self-contained community with all associated support systems in close proximity. All electrical requirements at the construction camps were assumed to be generated by diesel generators.

Construction camp electrical requirements could be supplied by the utility system. This will largely eliminate the need for diesel generators and their attendant air pollution and fuel transportation costs. If this is the case, then the given electrical load will be increased and diesel fuel consumption will be decreased.

The construction camps will be dismantled after the construction, assembly and checkout operation is completed.

The construction energy requirements for the DDA are site-specific and are discussed in Section 3.0.

DDA OPERATIONS: ENERGY REQUIREMENTS (2.4.2)

In comparison to the construction phase, the operations phase of the DDA will result in a reduced level of consumption of fossil fuels and an increase in the demand for electricity.

Fossil fuels will be used for emergency power, support vehicles, helicopters, and the transporter. Annual fuel requirements for the DDA include about three million gallons for standby diesel generators, 1.2 million gallons diesel fuel for the barrier vehicles and cranes, and about 7.5 million gallons of JP-4 for the transporters. The electrical energy requirements for the DDA operations summarized in Table 2.4.2-1 are typical for each full-basing and split-basing alternative. DDA energy requirements could be partially supplied with Renewable Energy System (RES), see Sections 5.4.1.1, 5.4.1.2, and 6.

Table 2.4.2-1. Electric power requirements for DDA.

Facilities	Number of Facilities	Loads Per Facility (kw) Peak Demand	Loads Per Facility (kw) Total Connected	Utilization Factor	Total-All Facilities (Mw) Peak Demand	Total-All Facilities (Mw) Total Connected	Total-All Facilities (Mw) Annual Use MWH
PSS	4600	23	33	0.8	1050.8	1510.8	741,446
RSS	200	12.3	15	0.8	2.5	3.0	17,520
CMF							
(Unmanned)	194	7	220	0.8	1.4	42.0	9,811
(Manned)	6	140	220	0.8	0.8	2.0	5,606
ASC	4	800	1400	0.8	3.2	5.6	22,426
Total Operating Requirements					113.7[1]	204.4	796,889

T5179/10-2-81

[1]Peak demands not additive due to diversity, assumed to be 1.25.

Source: Boeing Aerospace Corp. (June 18, 1981).

2.5 OPERATING BASES (OB): ENERGY REQUIREMENTS

OB CONSTRUCTION: ENERGY REQUIREMENTS (2.5.1)

As with the DDA, the operating base construction phase will require a construction camp. Along with the base construction, a marshaling yard will be in operation. This construction camp will also be self-contained with all life support being provided on site. All electrical demands were assumed to be met by diesel generators. Similars efforts, as with the DDA, are being made to supply the construction camp electrical requirements through the utility system. If that is the case, the given electrical will increase and the diesel fuel consumption will decrease. Some of the fuel requirements for heating will be provided by bottled gas trucked in from major distribution centers.

The energy requirements for the construction phase of the operating bases are site-specific and are discussed for each alternative in Section 3.0. The induced growth in the construction site areas will create support communities. These communities will require between about 30 and 55 Mw of electric demand.

OB OPERATIONS: ENERGY REQUIREMENTS (2.5.2)

The operating bases, when constructed, will utilize electricity for motors, lighting, communications, etc. The heating and domestic hot water source has been assumed to be fuel oil for the Nevada/Utah region, and natural gas for the Texas/New Mexico region. Cooling has been assumed to be electric (centrifugal chillers). This could be a central cooling and heating facility or dispersed central thermal plant located at each building as required.

Operating base facility and onbase housing thermal load requirements were taken from EDAW "M-X Base Comprehensive Plan" interim report 1, Deliverables 13 and 15 dated May 29, 1981. These loads were adjusted to include eighty percent of the total onbase housing load, to reflect the assumptions of the socioeconomic analyses of this FEIS.

Diesel generators will be installed at the operating bases and each of the distribution centers for critical loads in the event of a power outage.

The operations energy requirements for the OB are site-specific and are discussed for each alternative in Section 3.0. Operating base annual fuel consumptions include the following quantities:

Vehicle	Fuel	Million of gallons/year
ALCC (Radar planes)	JP4	28.
General/Special Vehicles	Diesel	0.5
General/Special Vehicles	Gasoline	1.0

The electrical energy requirements of the OB operations, summarized in Table 2.5.2-1, are typical for each full basing alternative, excluding the energy requirements for the associated population increase in affected support communities. These requirements are specific for each alternative and are covered in Section 3.0.

Table 2.5.2-1. Electric power requirements for each full basing alternative — operating bases.

Facilities	Number of Facilities	Loads per Facility (kW)		Utilization Factor	Total — All Facilities (MW)		
		Peak Demand	Total Connected		Peak Demand	Total Connected	Annual Use (MWH)
DAA[2]	1	11,898	19,325	0.33	11.9	19.3	34,400
OBTS	1	1,741	2,622	0.25	1.7	2.6	3,723
OB #1[2]	1	26,116	37,308	0.33	26.1	37.0	75,450
OB #2[2]	1	18,280	26,116	0.33	18.3	26.1	52,900
CCMF	1	12,000	16,300		12.0	16.3	
TOTALS[3]					58[(1)]	85	166,473

T5180/9-5-81

[1]Peak demands no additive due to diversity, assumed to be 1.25.
*Split basing alternative will include additional DAA.
*Total split basing operating demand requirement is 70 MW.
*Total annual energy requirement for split basing is 200,873 MWH.

[2]Heating, cooling and domestic hot water heating loads are not included.

[3]Totals do not include the CCHF loads.

Source: EDAW, "M-X comprehensive Plan, Deliverables 13 and 15 interim report 1," 1981, with 80% dwelling on base.

CENTRAL COOLING AND HEATING FACILITY (2.5.3)

A Central Cooling and Heating Facility (CCHF) is being considered. The CCHF is a coal-fired thermal energy production plant designed to meet the cooling, heating, hot water, and electrical needs of the operating base. The combined production of electrical and thermal energy in a single facility is termed cogeneration. The overall efficiency of the combined systems of a cogeneration facility provides a substantial reduction in consumption of fuel compared with either system considered separately. The facility will be designed to interface with utility services, with provisions to accommodate renewable energy systems (RES) if applicable.

The CCHF is to provide thermal energy for the DAA/CSA technical facilities, the OB, and the living area. The baseline concept assumes purchase of base electrical power from existing utilities. Cogeneration demands can supply total or partial electrical demands as well as total cooling and heating demands for the OB. The baseline and alternative cogeneration cases were compared on a 30-year life cycle basis.

The feasibility of incorporating cogeneration of electrical power at the CCHF is dependent upon site specific climatic conditions and base layout. In general, where cogeneration is feasible, it is most efficient to operate the facility to meet total electrical demand instead of varying output of electricity in accordance with heating and cooling load fluctuations. Since the amount of capital investment is established by the capacity of equipment required to meet peak demands, the unit costs for output decrease as the utilization of installed capacity is increased. The effect of adding increased heat rejection capacity is minor compared to cost savings accrued when total base electrical demands are provided by the CCHF.

Cogeneration at Coyote Spring provides positive life cycle cost benefit due to moderate winter heating demand and a heavy demand for summer cooling which results in a sustained demand for comfort energy year round. Cogeneration also provides positive life cycle cost benefits at Beryl and Milford, but not at Clovis.

There are no significant differences in the environmental quality ramifications with a cogeneration facility compared with the CCHF alone. While cogeneration involves some increase in the amount of pollutant emissions, no significant differences exist for permit acquisition procedures and anticipated pollution control equipment. The incorporation of Best Available Control Technology (BACT) air pollutant emission control systems have been included into CCHF concepts.

One electrostatic precipitator would be provided for each stream boiler to reduce fly ash from flue gases to acceptable levels under the worst case condition of coal firing. The flue gas desulfurization system would be designed to reduce the sulfer dioxide content of the flue gases from the electrostatic precipitator to acceptable limits before discharging to the chimney.

The facility utilizes air-atomized No. 2 fuel oil for start-up, with coal as the primary fuel. The diesel oil pumps are sized to provide up to 30 percent of the heat required for continuous operation. Solid waste generated at the base could potentially be utilized in the boilers as fuel, which could reduce the demand on coal.

Nonrecycled wastewater effluent from the boilers and cooling towers, water treatment systems, industrial drains, and coal pile runoff will be routed to an

evaporation pond. This is a "zero discharge" operation. Any sludge accumulations in the pond will be removed on an as-needed basis for landfill disposal.

An indepth study "Technical Operating Report on Central Cooling/Heating FacilityFeasibility Study at M-X Operating Base/DAA," has been prepared by the Ralph M. Parsons Company, subcontrator to Martin Marietta Corp., in response to BMO/AFRCE-M-X direction.

SUPPORT COMMUNITIES: ENERGY REQUIREMENTS (2.5.4)

During the construction phase, it is assumed that fifty percent of construction workers, twenty percent of military personnel, and all support workers will reside in local communities. During the operation phase, twenty percent of military personnel and all support workers will be living in the local communities (see ETRs 2B-2L and 3B-3C). This reflects the assumptions of the socioeconomic analysis of this FEIS. This population growth will result in a higher demand on electrical energy, natural gas, petroleum, oil, and lubricants in the communities. These support communities, will utilize electricity for motors, lighting, small appliances, etc. The heating and domestic hot water source has been assumed to be fifty percent electric, fifty percent oil for Nevada/Utah region, and twenty percent electric, eighty percent natural gas for Texas/New Mexico region. Cooling has been assumed to be electric. Should the Rocky Mountain Natural gas pipeline pass through the Nevada/Utah region and is available to the local communities, the combined electric and oil consumption will change to electric and natural gas with similar percentage as Texas/New Mexico. Further assumptions are made as far as percentage of type of heating, DHW, and cooling equipment to be used, like heat pumps, electric resistance heating, air conditioning, evaporation cooling, and window air.

SUMMARY TABLES FOR ENERGY REQUIREMENTS FOR OPERATING BASES AND SUPPORT COMMUNITIES (2.5.5)

Tables 2.5.5-1 and 2.5.5-2 present hourly peak demand and annual use of the operating bases and the support community for each alternative during operating phase year 1992. These energy requirements do not include present or future populations in the area who do not directly or indirectly support the M-X system.

2.6 ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

The current baseline plan, is to purchase all the electric power for the M-X system. Some other options being considered are a coal-fired power plant (cogeneration type), stand alone alternative energy systems and combinations of utility power and renewable energy systems. Whichever option is chosen, the M-X system will utilize some electrical transmission and distribution lines. A description of the baseline assumption in which the M-X system will purchase electrical power from utilities follows.

One of the M-X system concept (Boeing report dated 4/17/80) is shown in simplified form in Figure 2.6-1. Power will be taken from the utility transmission grid through substations that transform the typically high voltage, down to an appropriate transmission voltage class. The power will then be transmitted over transmission lines to area substations where voltage will be transformed to a nominal distribution voltage.

Table 2.5.5-1. Energy requirements for operating bases and support communities by alternative - hourly peak demands (with 80 percent of 4,200 dwellings) (Page 1 of 2).

Bases and Affected Communities	Heating Million BTU/Hr	Domestic Hot Water Million BTU/Hr	Total Heating & Hot Water Million BTU/Hr	Cooling Million BTU/Hr	Cooling Power (MW)	Other Electricity (MW)	Total Electric (MW)
	Hourly Peak Demand[1]						
Proposed Action							
Coyote, Nev.	168	36	204	157	21	40	61
Communities	56	20	76	47	3	3	6
Milford, Utah	151	25	176	86	11	18	29
Communities	97	29	126	63	2	4	6
Total	472	110	582	353	37	65	102
Alternative 1							
Coyote, Nev.	168	36	204	157	21	40	61
Communities	68	24	92	56	4	4	8
Beryl, Utah	151	25	176	86	11	18	29
Communities	82	24	106	52	2	4	6
Total	469	109	578	351	38	66	104
Alternative 2							
Coyote, Nev.	168	36	204	157	21	40	61
Communities	56	20	76	47	3	3	6
Delta, Utah	163	25	188	94	12	18	30
Communities	76	21	97	46	2	3	5
Total	463	102	565	344	38	64	102
Alternative 3							
Beryl, Utah	216	36	252	123	16	40	56
Communities	107	32	139	68	2	5	7
Ely, Nev.	173	25	198	75	10	18	28
Communities	95	27	122	58	1	4	5
Total	591	120	711	324	29	67	96

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Table 2.5.5-1. Energy requirements for operating bases and support communities by alternative - hourly peak demands (with 80 percent of 4,200 dwellings) (Page 2 of 2).

Bases and Affected Communities	Heating Million BTU/Hr	Domestic Hot Water Million BTU/Hr	Total Heating & Hot Water Million BTU/Hr	Cooling Million BTU/Hr	Cooling Power (MW)	Other Electricity (MW)	Total Electric (MW)
	Hourly Peak Demand[1]						
Alternative 4							
Beryl, Utah	216	36	252	123	16	40	56
Communities	109	32	141	70	2	5	7
Coyote, Nev.	117	25	142	110	15	18	33
Communities	52	19	71	43	3	3	6
Total	494	112	606	346	36	66	102
Alternative 5							
Milford, Utah	216	36	252	123	16	40	56
Communities	128	38	166	83	3	6	9
Ely, Nev.	173	25	198	75	15	18	33
Communities	80	22	102	46	1	3	4
Total	597	121	718	327	35	67	102
Alternative 6							
Milford, Utah	216	36	252	123	16	40	56
Communities	131	39	170	84	3	6	9
Coyote, Nev.	117	25	142	110	15	18	33
Communities	37	13	50	31	2	2	4
Total	501	113	614	348	36	66	102
Alternative 7							
Clovis, N.M.	188	36	224	129	17	40	57
Communities	107	33	140	72	4	5	9
Dalhart, Tex.	136	25	161	94	12	18	30
Communities	195	58	253	129	7	9	16
Total	626	152	778	424	40	72	112
Alternative 8							
Coyote, Nev.	168	36	204	157	21	40	61
Communities	61	22	83	51	3	3	6
Clovis, N.M.	147	28	175	101	13	30	43
Communities	145	45	190	98	6	7	13
Total	521	131	652	407	43	80	123

T5203/9-24-81/F

[1] Without conservation.

Note: Total electric load does not include electric heating and DHW loads.

Source: HDR Sciences.

Table 2.5.5.2. Energy requirements for operating bases and support communities by alternative - annual use (with 80 percent of 4,200 dwellings) (Page 1 of 2).

	Annual Use[1]						
Bases and Affected Communities	Heating Billion BTU	Domestic Hot Water Billion BTU	Total Heating & Hot Water Billion BTU	Cooling Billion BTU	Cooling Power Thousand MWH	Other Electricity Thousand MWH	Total Electric Thousand MWH
Proposed Action							
Coyote, Nev.	287	90	377	300	25	114	139
Communities	99	53	152	90	9	21	30
Milford, Utan	332	62	394	98	8	53	61
Communities	218	76	294	68	3	30	33
Total	936	281	1,217	556	45	218	263
Alternative 1							
Coyote, Nev.	287	90	377	300	25	114	139
Communities	119	64	183	109	11	25	36
Beryl, Utan	332	62	394	98	8	53	61
Communities	181	64	245	59	3	25	28
Total	919	280	1,119	566	47	217	264
Alternative 2							
Coyote, Nev.	287	90	377	300	25	114	139
Communities	99	53	152	90	9	21	30
Delta, Utah	342	62	404	100	8	53	61
Communities	160	55	215	49	2	22	24
Total	888	260	1,148	539	44	210	254
Alternative 3							
Beryl, Utah	475	90	565	140	12	114	126
Communities	235	83	318	77	4	33	37
Ely, Nev.	427	62	489	41	3	53	56
Communities	221	71	292	51	3	28	31
Total	1,358	306	1,664	309	22	228	250
Alternative 4							
Beryl, Utah	475	90	565	140	12	114	126
Communities	241	85	326	79	4	34	38
Coyote, Nev.	201	62	263	210	17	53	70
Communities	92	49	141	83	8	19	27
Total	1,009	286	95	512	41	220	261

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Table 2.5.5.2. Energy requirements for operating bases and support communities by alternative - annual use (with 80 percent of 4,200 dwellings) (Page 2 of 2).

	Annual Use[1]						
Bases and Affected Communities	Heating Billion BTU	Domestic Hot Water Billion BTU	Total Heating & Hot Water Billion BTU	Cooling Billion BTU	Cooling Power Thousand MWH	Other Electricity Thousand MWH	Total Electric Thousand MWH
Alternative 5							
Milford, Utah	475	90	565	140	12	114	126
Communities	287	100	387	90	5	39	44
Ely, Nev.	427	62	489	41	3	53	56
Communities	195	57	252	27	1	22	23
Total	1,384	309	1,693	298	21	228	249
Alternative 6							
Milford, Utah	475	90	565	140	12	114	126
Communities	293	102	395	92	5	40	45
Coyote, Nev.	201	62	263	210	17	53	70
Communities	65	34	99	59	6	14	20
Total	1,034	288	1,322	501	40	221	261
Alternative 7							
Clovis, N.M.	309	90	399	268	22	114	136
Communities	179	87	276	152	13	31	44
Dalhart, Tex.	224	62	286	190	16	53	69
Communities	290	154	444	282	25	55	90
Total	1,002	393	1,405	892	76	253	339
Alternative 8							
Coyote, Nev.	287	90	377	300	25	114	139
Communities	108	57	165	98	10	23	33
Clovis, N.M.	242	70	312	210	17	87	104
Communities	237	118	355	208	18	42	60
Total	874	335	1,209	816	70	266	336

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[1] Without conservation.

Note: Total electric load does not include electric heating and DHW loads.

Source: HDR Sciences.

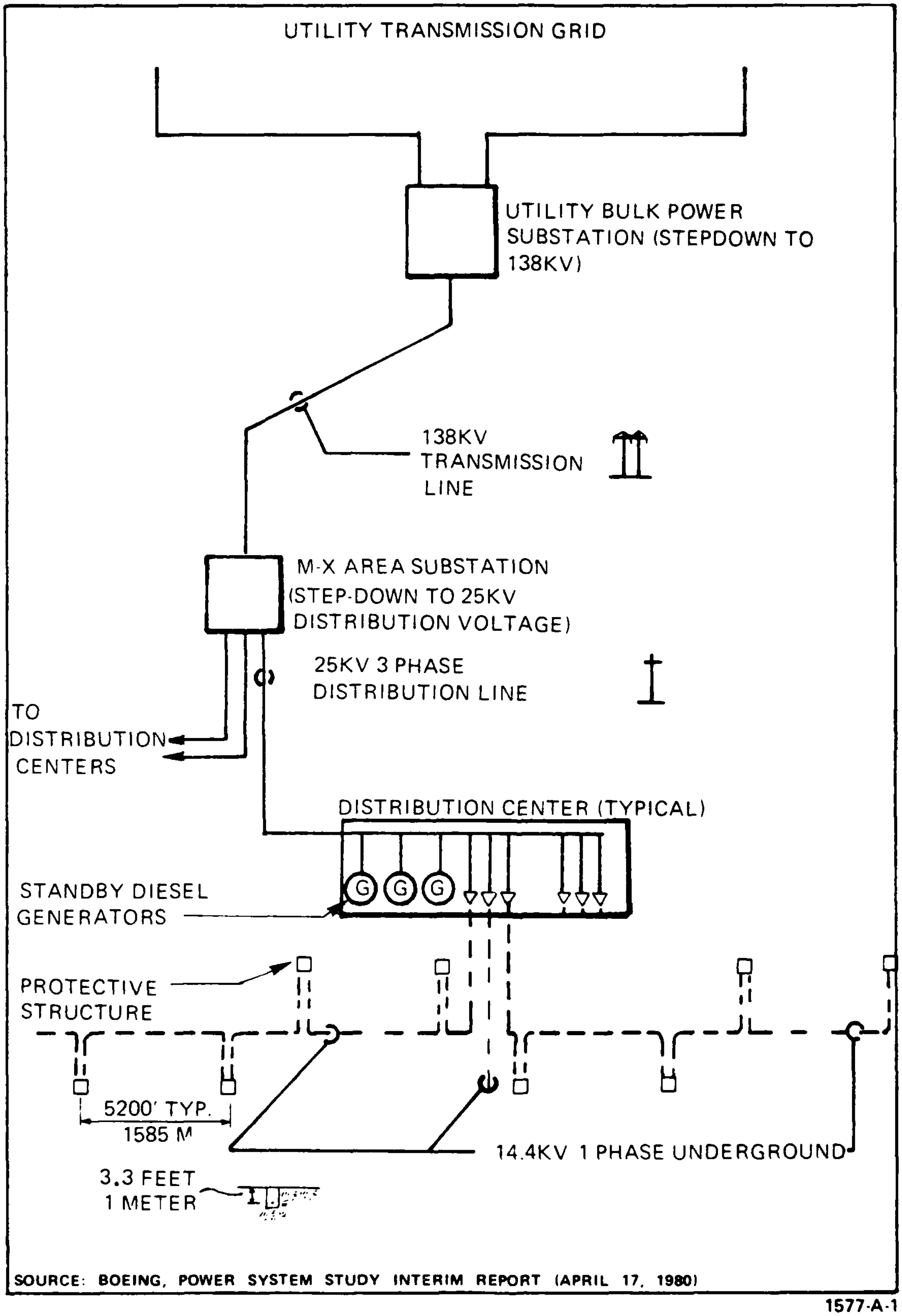


Figure 2.6-1. M-X power system concept.

Power from the area substations could be transmitted via overhead distribution lines to distribution centers dispersed throughout the DDA. Underground cables will be used to transmit power from the distribution lines to M-X distribution centers to protective structures and other DAA facilities. Standby diesel generators will be available at the distribution centers to supply power in the event of an outage.

The actual system of transmission lines, substations, and distribution lines to serve M-X will be developed in accordance with USAF reliability criteria and long-range utility planning considerations. Specific transmission system details, such as transmission line and substation locations, cannot be determined until a specific site and basing configuration is established. However, it is possible to indicate the general type and approximate quantity of transmission facilities required, based on a conceptual design for a representative Nevada/Utah basing configuration Figure 2.6-2 (Boeing/EDA, 12/31/79).

This figure shows a possible system of utility bulk-power substations, 138 kv transmission lines, M-X area substations, and base substations. It is not intended to show proposed transmission line or substation locations, but it does provide a useful quantitative picture.

The M-X electrical load will be dispersed over the wide geographical extent of the DDA. From a transmission system design standpoint, the primary problem will be one of maintaining voltage support over distance, not bulk-power transfer. For this reason, a proliferation of large bulk-power transmission lines is not anticipated. For example, a computer transmission network load-flow optimization study for the representative Nevada/Utah design shows that the relatively light and widely distributed M-X load can be supplied by 138 kv transmission lines in the same voltage range - primarily 115 kv lines - prevalent throughout Texas and New Mexico. It should be noted that most new or proposed bulk-power transmission lines in this county are rated 345 or 500 kv, and that a 115 or 138 kv line is relatively small in terms of voltage carried.

TRANSMISSION LINES (2.6.1)

The design of the transmission lines will be determined by Air Force and utility standards, wind and ice loading conditions, right-of-way considerations, terrain, and other factors. Typical structure types for a 138 kv line include the compact "line post" design and the "H-frame" design, illustrated in Figures 2.6.1-1 and 2.6.1-2. The actual type and number of structures and miles of lines required for the system are dependent on specific site conditions.

SUBSTATIONS (2.6.2)

The actual number of substations required will depend on actual basing configuration and the density of existing distribution substations in the DDA. It is anticipated that there will be at least one substation for each base. The representative Nevada/Utah design shown in Figure 2.6-2 has five utility bulk-power substations, twelve area substations, and one base substation. Utilities would provide power up to the distribution centers.

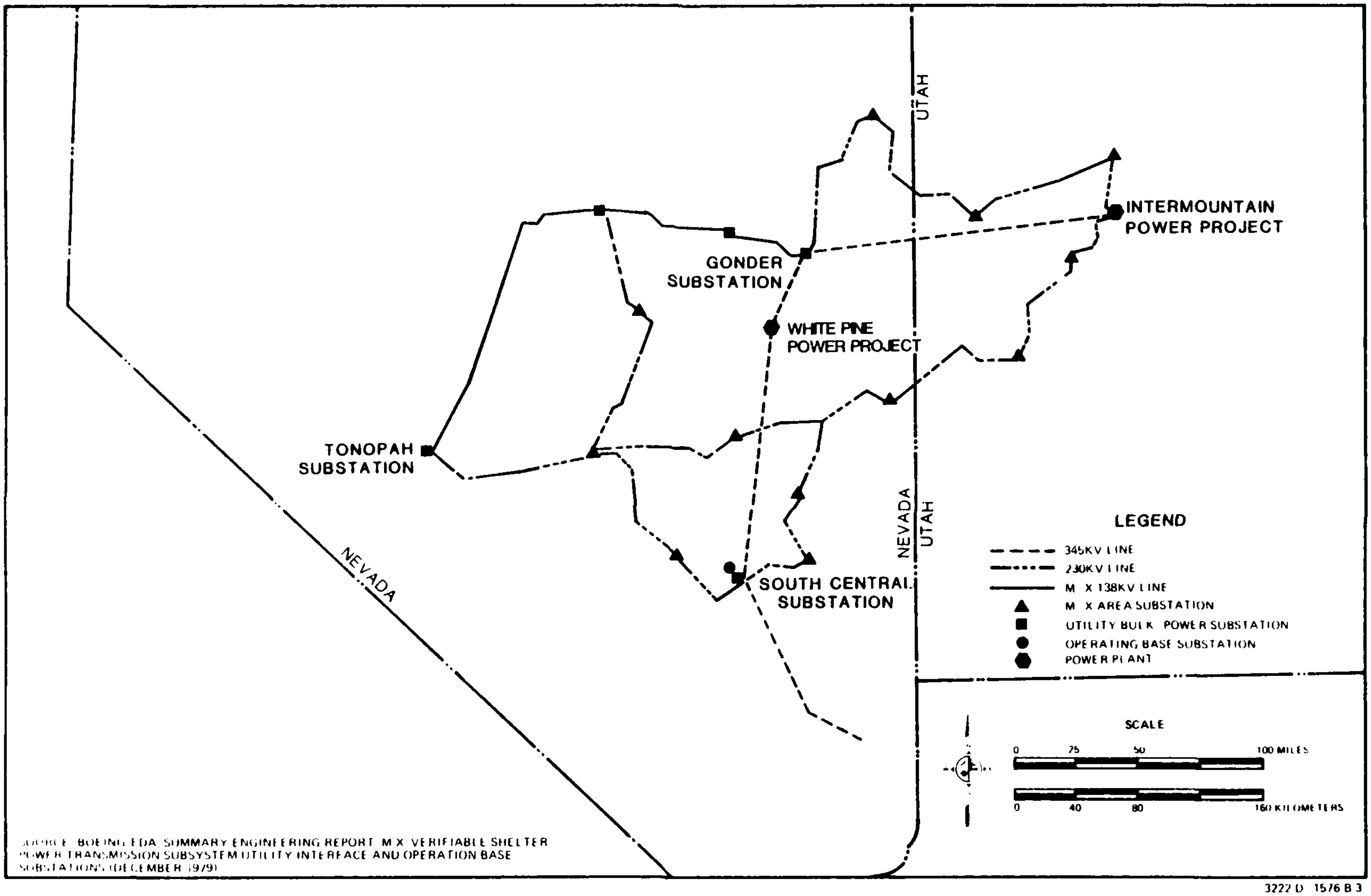
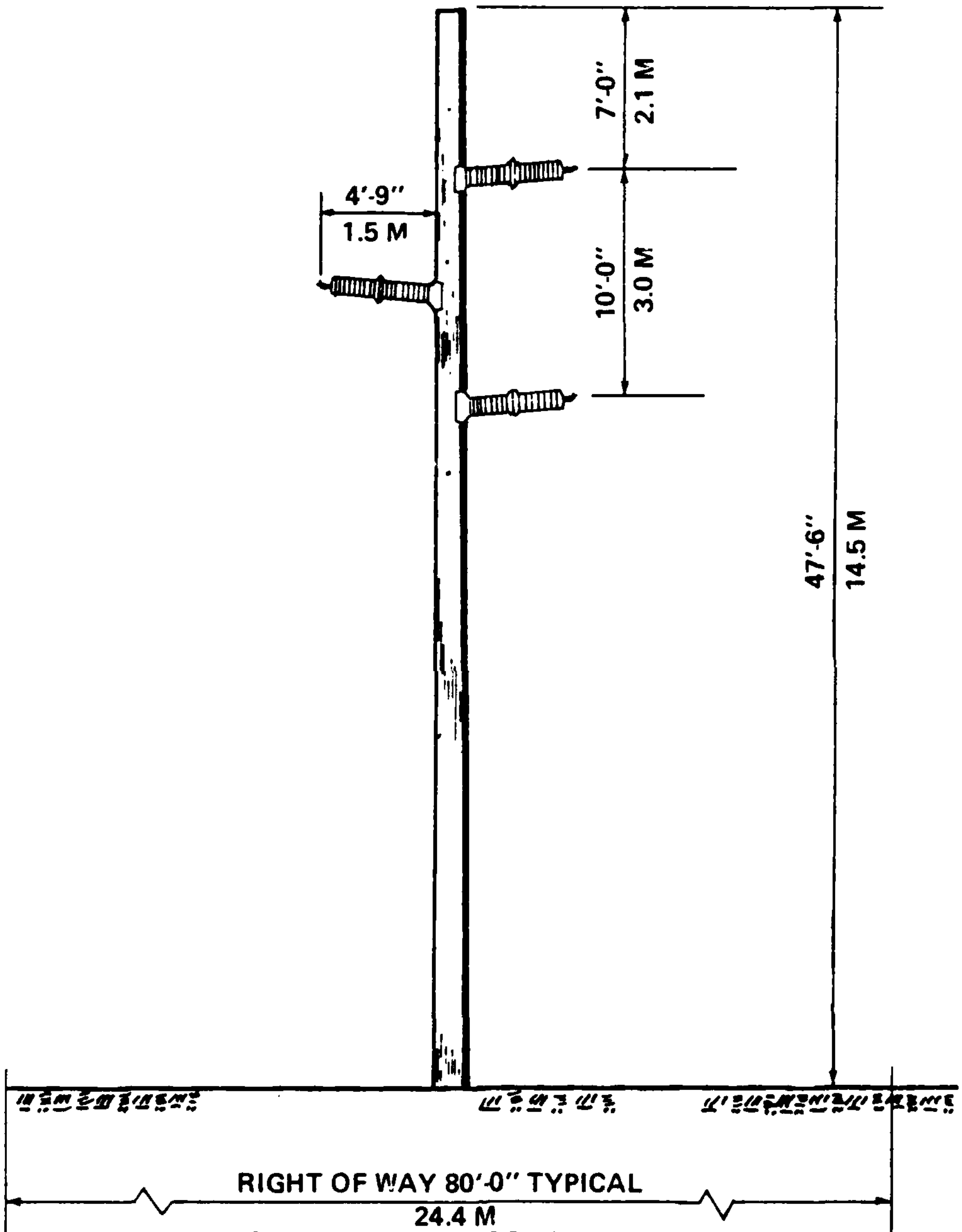


Figure 2.6-2. Conceptual Nevada/Utah transmission system configuration.

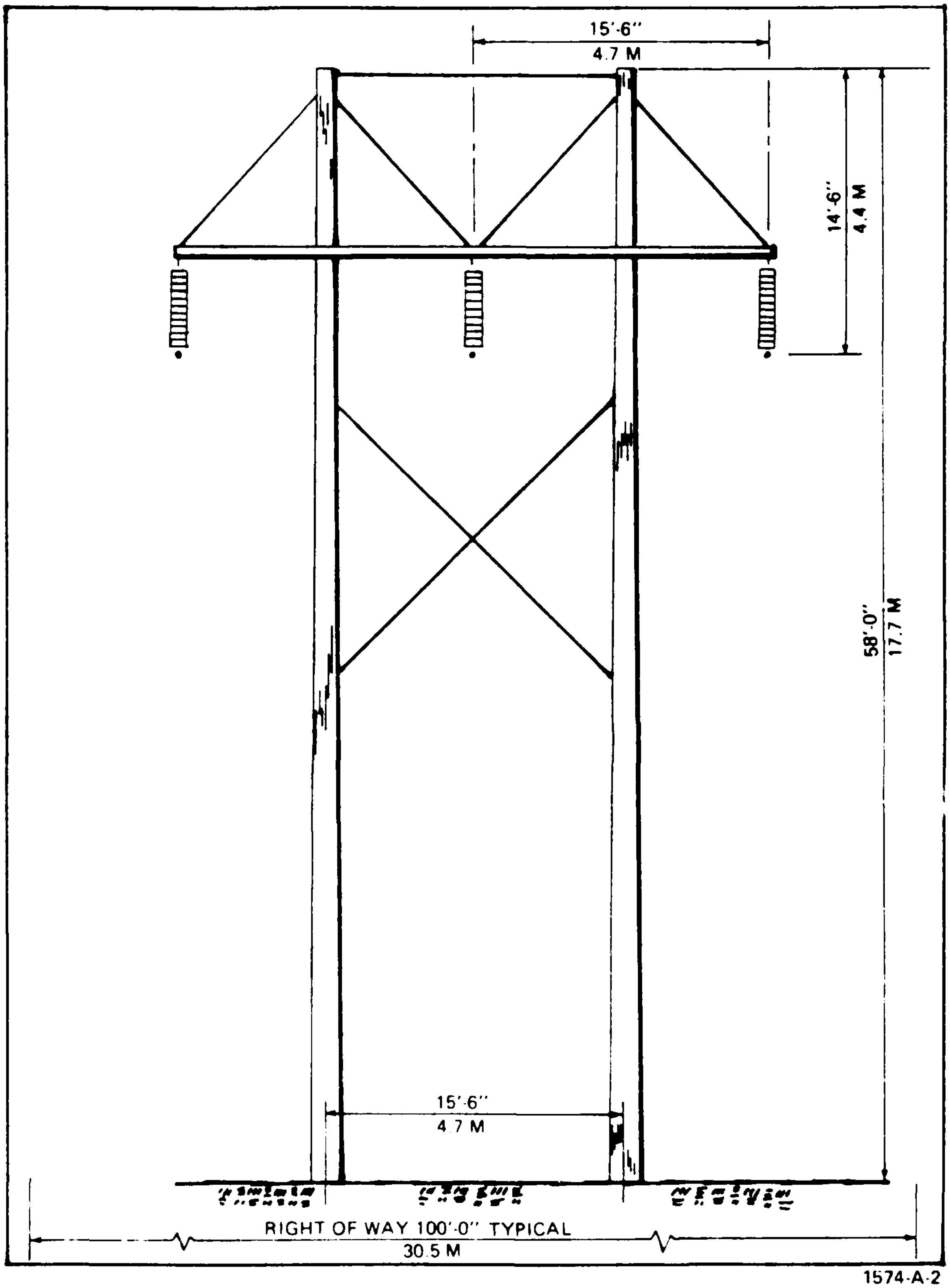


SOURCE: BOEING/EDA, SUMMARY ENGINEERING REPORT, M-X VERIFIABLE SHELTER, POWER TRANSMISSION SUBSYSTEM UTILITY INTERFACE AND OPERATION BASE SUBSTATIONS (DECEMBER 1979)

1572-A-2

POST STRUCTURE

Figure 2.6.1-1. 138 kV transmission line post structure.



SOURCE. BOEING/EDA, SUMMARY ENGINEERING REPORT, M-X VERIFIABLE SHELTERS, POWER TRANSMISSION SUBSYSTEM UTILITY INTERFACE AND OPERATION BASE SUBSYSTEMS (DECEMBER 1979)

Figure 2.6.1-2. 138 kV transmission line H-frame structure.

Figures 2.6.2-1 through 2.6.2-3 show typical dimensions for utility bulk-power substations, operating base substations, and area substations, respectively. Fenced areas for the three types of substations are utility bulk-power substations of 5.4 acres (2.2 hectares) operating base substations of 1.6 acres (0.65 hectare) each, and area substations of 0.8 acre (0.3 hectare), each.

OVERHEAD DISTRIBUTION LINES (2.6.3)

A typical 25 kv distribution structure for overhead lines is shown in Figure 2.6.3-1. Commonly found in residential areas and on rural distribution systems, this type of structure is normally constructed on or immediately adjacent to the road right-of-way. The 25 kv distribution voltage is more precisely termed 24.9 Y/14.4 kv. This designation means that the distribution lines carry 14.4 kv single-phase power and 24.9 kv three-phase power.

Because of the large number of distribution centers required for the system (approximately 120), a substantial mileage of overhead distribution lines, will be needed. The representative Nevada/Utah conceptual design required 1,700 miles of 25 kv distribution lines. The requirement for new lines will vary depending on the actual site.

Texas/New Mexico regions have extensive distribution systems which could be utilized to serve M-X in addition to other loads; this would minimize the need for new line construction.

DISTRIBUTION CENTERS (2.6.4)

The main equipment required for a distribution center is shown in Figure 2.6.4-1. The representative Nevada/Utah conceptual design requires about 120 distribution centers. However, the actual number and location of distribution centers will depend on the basing configuration.

UNDERGROUND POWER CABLES (2.6.5)

Within the clusters, power would be transmitted through underground cables. These cables supply 14.4 kv single-phase power to protective structures and remote surveillance sites and supply 24.9 kv three-phase power to cluster maintenance facilities and deployment area support centers.

Three possible methods of power cable installation are: duct bank installation, cable plowing, and trenching and backfilling. Underground power cable installation is to be confined to the M-X project road right-of-way.

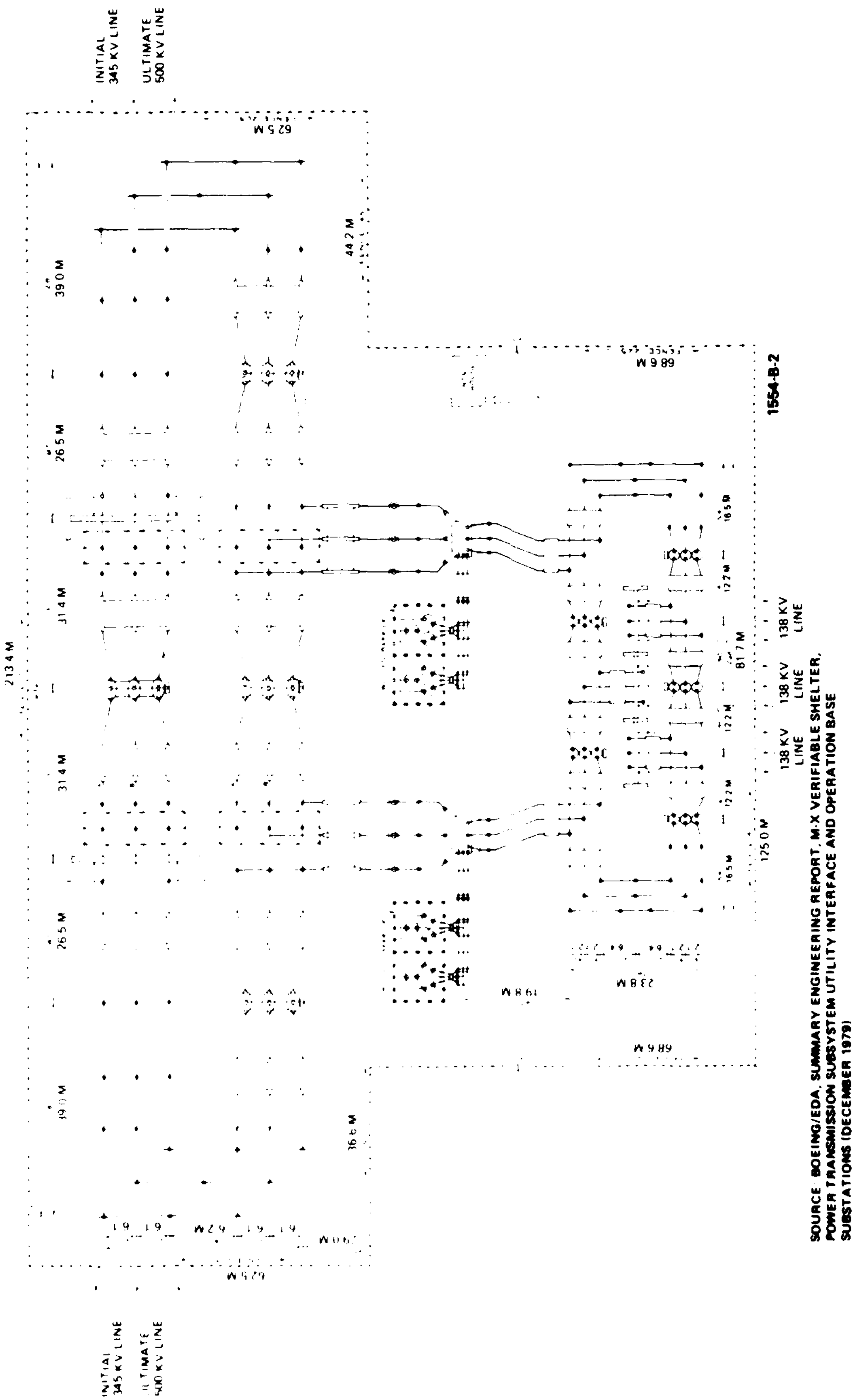
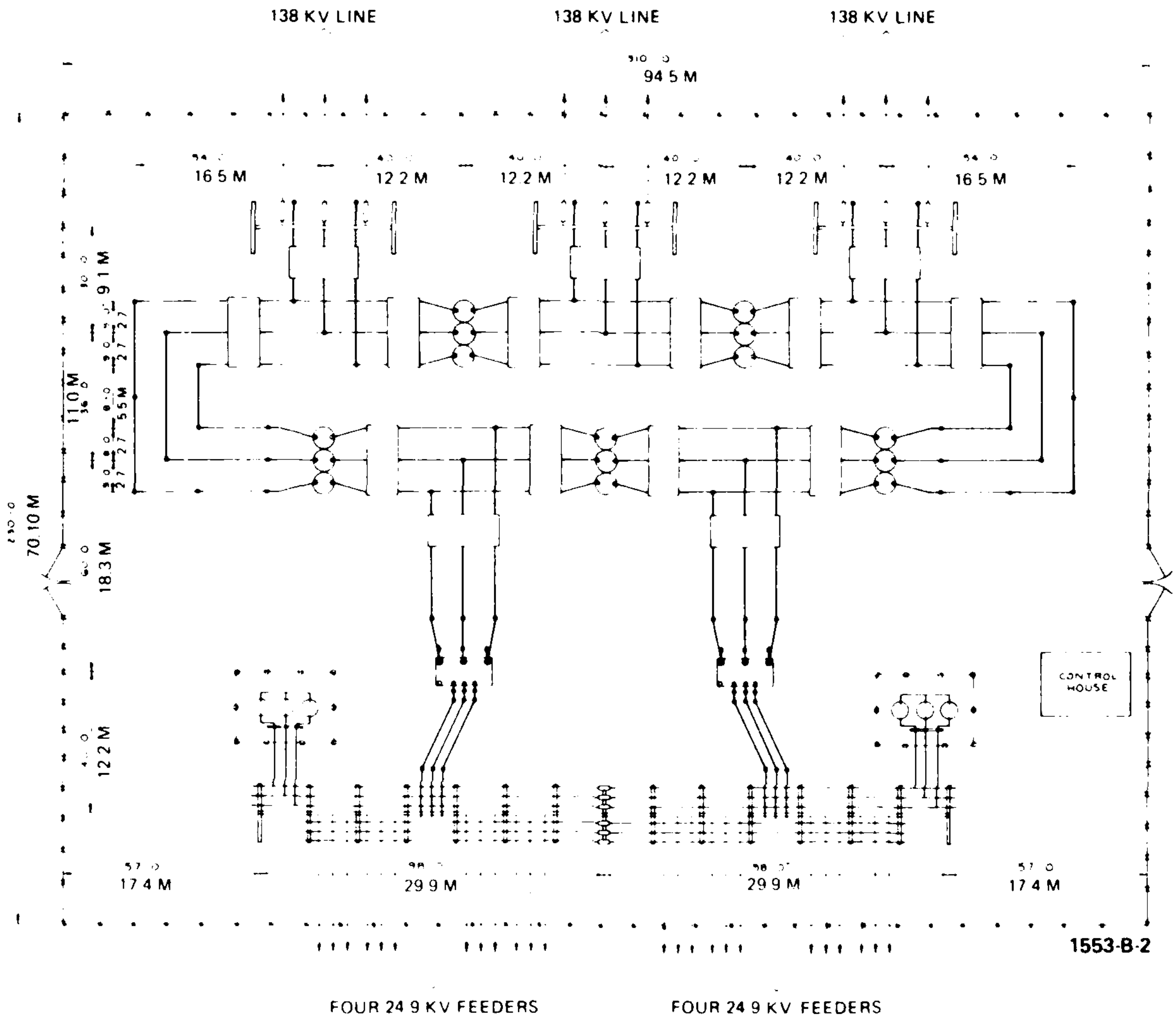
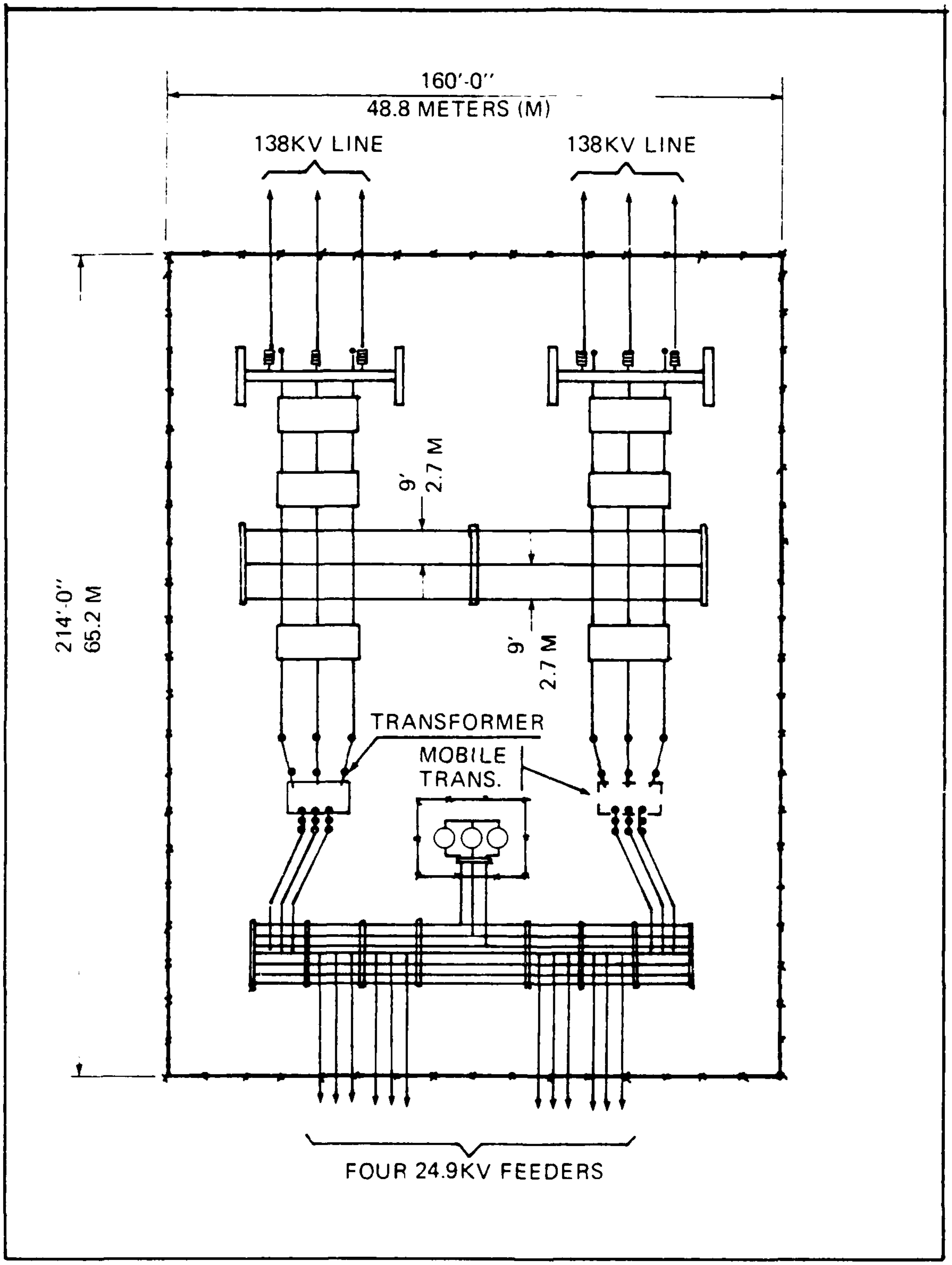


Figure 2.6.2-1. Typical utility bulk-power substation.



SOURCE BOEING EDA, SUMMARY ENGINEERING REPORT, M X VERIFIABLE SHELTERS, POWER TRANSMISSION SUBSYSTEM UTILITY INTERFACE AND OPERATION BASE SUBSTATIONS (DECEMBER 1979)

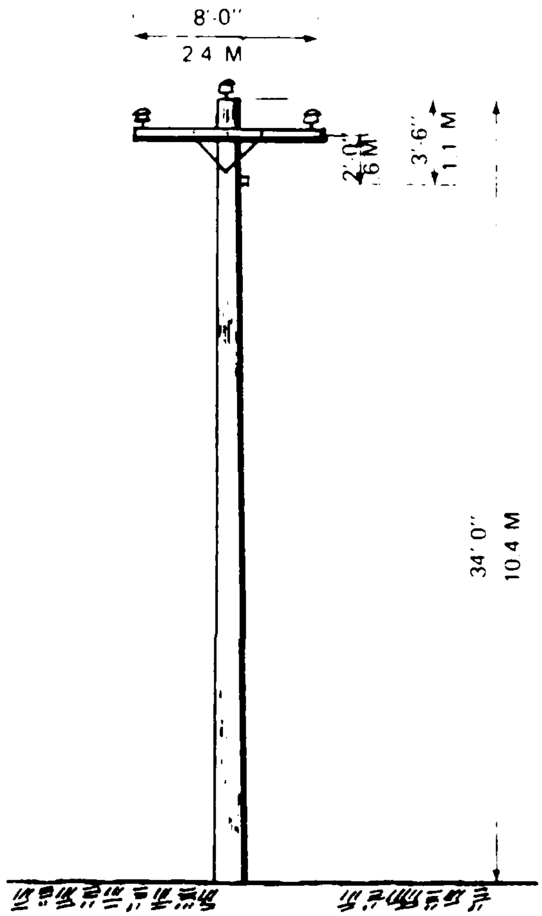
Figure 2.6.2-2. Typical operating base substation.



1581-A-1

SOURCE: BOEING/EDA, SUMMARY ENGINEERING REPORT, M-X VERIFIABLE SHELTER, POWER TRANSMISSION SUBSYSTEM UTILITY INTERFACE AND OPERATION BASE SUBSTATIONS (DECEMBER 1979)

Figure 2.6.2-3. Typical M-X area substation.



SOURCE: BOEING/EDA, SUMMARY ENGINEERING REPORT, M-X VERIFIABLE SHELTER, POWER TRANSMISSION SUBSYSTEM UTILITY INTERFACE AND OPERATION BASE SUBSTATIONS (DECEMBER 1979)

1573-A-1

Figure 2.6.3-1. Typical 25 kV overhead distribution line structure.

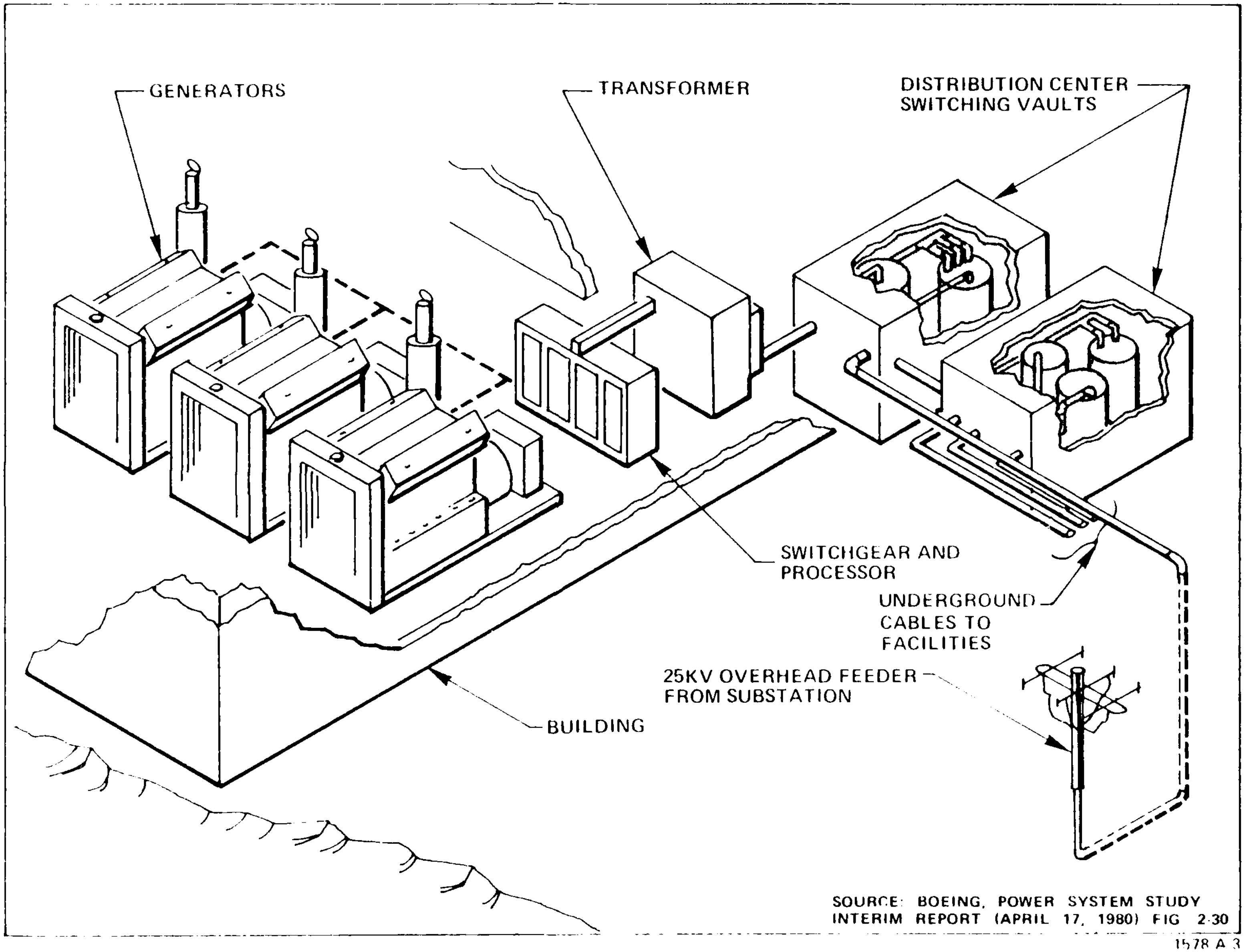


Figure 2.6.4-1. Distribution center equipment.

3.0 ALTERNATIVES

This section discusses site-specific fuel and electric energy requirements for each of the nine proposed alternatives for the M-X system.

Fuel and electric energy would be required for both the construction and operation of the M-X designated deployment areas and operating bases plus the increased population entering the region to support the system. Diesel fuel and gasoline will be required for vehicles during both construction and operation, for construction equipment and electric generation during construction and for standby diesel generators in the operating base power house and the DDA. Based on an assessment of the available sources of energy in the deployment areas, it is assumed that No. 2 fuel oil in Nevada/Utah and natural gas in Texas/New Mexico will be used to meet space heating and hot water heating needs in these regions. Electrically driven air conditioning units are assumed in all cases. For local community housing, it is assumed that combinations of electricity and fuel oil for Nevada/Utah and combinations of natural gas and electric power in Texas/New Mexico will meet the space heating and hot water heating needs. Electricity will be used for cooling purposes in all cases.

The primary considerations in comparing alternate sites with respect to electrical energy are (1) the planning, engineering, construction, and maintenance resources of the affected utility; (2) bulk-power availability; and (3) the adequacy of existing transmission and distribution facilities serving the proposed base and deployment areas. New facilities can be constructed if needed, but cost and lead time considerations are signficant.

Estimated overall fuel and electrical energy requirements for each alternative are given in Table 2.2-1 showing the maximum annual requirements for construction and operation (1986 data) and Table 2.2-2 operation (1992 data). Total energy requirements of the construction period for each alternative are given in Table 2.2-3.

3.1 PROPOSED ACTION - COYOTE SPRING VALLEY; MILFORD

The Proposed Action (P A) is located in the Nevada/Utah region with a First Base at Coyote Spring Valley, Nevada and a Second Base at Milford, Utah. Energy requirements for construction and operation (1986) are presented in Table 3.1-1 and for operations in 1992 are represented in Table 3.1-2.

ELECTRIC POWER (3.1.1)

Designated Deployment Area (DDA)

As shown on the plot, the Nevada/Utah region has very limited transmission facilities. The only bulk-power line in the area, Sierra Pacific's 230 kv line, is currently operating near capacity and is not available for M-X requirements. The major transmission lines associated with the proposed IPP and White Pine generating plants are scheduled to be in service in 1986. Transmission facilities to supply M-X prior to 1986 will be severely limited unless construction schedules can be moved up.

Table 3.1-1. (1986) Annual energy requirements – Proposed Action.

Use Category	Nevada P.O.L.[1] Gas 10^6 GA	Nevada P.O.L.[1] Diesel 10^6 GA	Nevada F.O.[2] 10^6 GA	Nevada Nat. Gas 10^6 CF	Nevada Electricity Demand MW	Nevada Electricity Use 10^3 MWH	Utah P.O.L.[1] Gas 10^6 GA	Utah P.O.L.[1] Diesel 10^6 GA	Utah F.O.[2] 10^6 GA	Utah Nat. Gas 10^6 CF	Utah Electricity Demand MW	Utah Electricity Use 10^3 MWH	Total P.O.L.[1] Gas 10^6 GA	Total P.O.L.[1] Diesel 10^6 GA	Total F.O.[2] 10^6 GA	Total Nat. Gas 10^6 CF	Total Electricity Demand MW	Total Electricity Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	26						15						41					
Support–Camps		3						2						5				
Support–Communities[3]			4		74	289			4		61	232			8		135	521
Bases																		
Equipment & Vehicles	1	1											1	1				
Commute & Recreation[3]	8						8						16					
Support–Camps		1						1						2				
Support–Communities[3]			1		22	84			1		20	80			2		42	164
Total	37	37	5		96	373	24	16	5		81	312	61	53	10		177	685
Operations																		
DDA		5			43	298					18	128		5			61	426
Bases																		
Technical Operations	1	10			14	38							1	10			14	38
Support–Onbase			3		47	100									3		47	100
Support–Offbase[3]			3		58	225					2	6			3		60	231
Commute & Recreation[3]	6												6					
Total	7	15	6		162	661					20	134	7	15	6		182	795

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[1]P.O.L. = Petroliem, oils, and lubriants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.1-2. (1992) Annual energy requirements - Proposed Action.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA	1	10			80	558					34	240	1	10			114	798
Bases																		
Technical Operations	1	29			14	38											14	38
Support-Onbase			3		47	100			4		29	61	1	29	7		76	161
Support-Offbase[3]			1		12	47			1		18	71			2		30	118
Commute & Recreation[3]	21						14						35					
Total	23	39	4		153	743	14		5		81	372	37	39	9		234	1115

T5205/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Most of the medium-voltage transmission lines or subtransmission lines required to supply M-X area substations would have to be newly constructed due to the scarcity of such lines in the Nevada/Utah region. Because of the low density of rural distribution lines in the area, a substantial mileage of new distribution lines in the 25 kv or 12.5 kv range would also have to be newly constructed to supply M-X distribution centers.

Electrical energy for the Nevada/Utah DDA could be obtained by scheduling power with area utilities or obtaining bulk power from Western. The power could be supplied from currently planned generating projects such as the H. Allen plant at Dry Lake, Nevada, the White Pine plant in White Pine County, Nevada, the IPP plant near Lyndall, Utah, the Moon Lake project in northeastern Utah and the North Valmy plant in Humboldt, Nevada.

First Base: Coyote Spring Valley

There are no electrical load or power system facilities in Coyote Spring. This area is on the southern boundary of the Lincoln County Power District (LCPD), which has a system peak demand of approximately 16 Mw. The estimated electrical load increase in the Coyote Spring area due to the M-X base in 71 Mw. It is anticipated that power for a base at Coyote Spring could be supplied from the proposed H. Allen plant at Dry Lake, Nevada and IPP plant near Lyndall, Utah. Both the H. Allen and IPP plants are scheduled for 1986 completion. Nevada Power Company representatives state that M-X bulk-power requirements are significant, and they stress the importance of an early and definite commitment by the Air Force to permit scheduling of power in accordance with required lead times.

A 69 kv transmission line from the Reid-Gardner plant passes through the area, but the line may be operating at capacity and might not be utilized to supply a base at Coyote Spring. Because there are no suitable transmission lines in the area, transmission facilities would have to be newly constructed to serve M-X. Coyote Spring is on the boundary between the service areas of LCPD and the Nevada Power Company and these two utilities have met to discuss how the M-X load might be served. Based on these meetings, it is anticipated that there would be close cooperation between LCPD and the Nevada Power Company.

Second Base: Milford

Electric power is supplied to the Milford area by Utah Power and Light Company via two 46 kv lines with a present load of about 5 Mw. The bulk-power requirements for the operating base and associated area population increase are estimated to be about 47 Mw. An effort must be made to schedule the construction of the operating base and the proposed power projects in the region to assure that electric power is available when required.

FUEL SUPPLY (3.1.2)

Designated Deployment Area (DDA)

As previously mentioned, there are relatively few pipelines in the Nevada/Utah deployment area. Fuel storage and distribution facilities would probably be constructed to support the project.

First Base: Coyote Spring Valley

Coyote Spring is located approximately 55 miles north-northeast of Las Vegas in a sparsely populated area with no natural gas service. The closest natural gas service is about 8 to 10 miles north of Las Vegas. Natural gas service could be extended to the Coyote Spring area by Southwest Gas Corporation of Las Vegas, but presently there are no plans for such expansion.

The closest petroleum product pipeline in the area is the CAL-NEV pipeline which terminates at Las Vegas. The bottled gas, fuel oil, gasoline, and diesel fuel distributors that truck these fuels throughout the region do not have the capacity to handle the increased fuel demand associated with the influx of people for the M-X project. Natural gas and/or petroleum product pipelines could be extended into the Coyote Spring area for the M-X project, or the present fuel hauling capabilities would have to be expanded.

Second Base: Milford, Utah

Milford is located in an area without natural gas service. Service could be extended into the area by Mountain Fuel Supply (MFS) in Salt Lake City, but there are no plans for such expansion.

Pacific Gas Transmission (PGT), a subsidiary of Pacific Gas and Electric in San Francisco, has proposed to build a 36-inch high-pressure gas transmission line from southwest Wyoming, passing east of Provo, Utah near Strawberry Reservoir, and continuing northwest of Cedar City, Utah and east of Las Vegas, Nevada to Southern California. This line will have sufficient capacity to transport natural gas for M-X if the USAF can make commitments soon enough for MFS and PGT to reach the appropriate agreements.

Home energy requirements in Milford are presently supplied by bottled gas, fuel oil, and electricity. The fuels are trucked from bulk fuel handling terminals in Las Vegas and Salt Lake City to regional distribution centers in St. George and Cedar City. If natural gas service is extended into the area, the fuel trucking companies could help supply the increased gasoline and diesel fuel loads. However, a considerable portion of the increased fuel demands would have to be transported by expanding the present truck fleet, by adding new suppliers, or by using military tanker trucks.

3.2 ALTERNATIVE 1 - COYOTE SPRING VALLEY; BERYL

Alternative 1 is located in the Nevada/Utah region with a First Base at Coyote Spring Valley, Nevada and a Second Base at Beryl, Utah. Energy requirements for construction and operation 1986 are presented in Table 3.2-1 and for operation 1992 are presented in Table 3.2-2. The fuel supply situation is similar to the Proposed Action for the first OB at Coyote Spring, Nevada.

Electrical power is supplied to the Beryl area by Dixie-Escalante Rural Electric Association, Inc., which has a peak system demand of approximately 20 MW. The utility purchases its power from the Western Area Power Administration and the Department of Energy. Beryl is presently served by a 12.5 kv rural distribution line. New transmission facilities would be required to handle a substantial load increase.

Table 3.2-1. (1986) Annual energy requirements - Alternative 1.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	26						14						40					
Support-Camps		3						2						5				
Support-Communities[3]			4		74	289			4		53	198			8		127	487
Bases																		
Equipment & Vehicles	1	1											1	1				
Commute & Recreation[3]	8						8						16					
Support-Camps		1						1						2				
Support-Communities[3]			1		23	91			2		27	104			3		50	195
Total	37	37	5		97	380	23	16	6		80	302	60	53	11		177	682
Operations																		
DDA		5			43	298					18	128		5			61	426
Bases																		
Technical Operations	1	10			14	38							1	10			14	38
Support-Onbase			3		47	100									3		47	100
Support-Offbase[3]			3		58	225					2	9			3		60	234
Commute & Recreation[3]	6												6					
Total	7	15	6		162	661					20	137	7	15	6		182	798

T5207/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.
[2]F.O. - Fuel oils.
[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.2-2. (1992) Annual energy requirements - Alternative 1.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA	1	10			80	558					34	240	1	10			114	798
Bases																		
Technical Operations	1	29			14	38							1	29			14	38
Support-Onbase			3		47	100			4		29	61			7		76	161
Support-Offbase[3]			1		15	57			1		15	59			2		30	116
Commute & Recreation[3]	21						13						34					
Total	23	39	4		156	753	14		5		78	360	36	39	9		234	1113

T5208/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

The estimated electrical load increase in the Beryl area due to the M-X base and the anticipated population increase is 44 MW. The present Dixie-Escalante system peak demand is approximately 20 MW.

3.3 ALTERNATIVE 2 - COYOTE SPRING VALLEY; DELTA

Alternative 2 is located in the Nevada/Utah region with a First Base at Coyote Spring Valley, Nevada and a Second Base at Delta, Utah. Energy requirements for construction and operation 1986 are presented in Table 3.3-1 and for operation 1992 are presented in Table 3.3-2. The fuel and electric power situations are similar to the Proposed Action, for the first OB at Coyote Spring, Nevada.

Delta is located in an area without natural gas service. Service could be extended into the area by the Mountain Fuel Supply of Salt Lake City, but there are no plans for such an expansion. Delta is approximately 26 mi west of the pipeline route proposed by Pacific Gas Transmission as described in the Proposed Action for Coyote Spring and Milford. Home energy requirements are supplied by bottled gas, fuel oil and electricity as described for the Proposed Action.

Electric power is supplied to the Delta area by Utah Power and Light Company via two 46 kV subtransmission lines. The present electrical load at Delta is 6 MW. The estimated increase in electrical load due to the population increase associated with a base is 43 MW.

3.4 ALTERNATIVE 3 - BERYL; ELY

Alternative 3 is located in the Nevada/Utah region with a First Base at Beryl, Utah and a Second Base at Ely, Nevada. Energy requirements for construction and operation 1986 are presented in Table 3.4-1 and for operation 1992 are presented in Table 3.4-2. Because of the more severe climates, the heating and cooling requirements for Alternative 3 are higher than for the Proposed Action. The energy supply situation for Beryl has been discussed in Alternative 1. The estimated electrical load increase in the Beryl area due to the M-X as a first OB and the anticipated population increase is 76 MW.

The Second Base at Ely is in an area without natural gas service. Service could be extended into the area by Southwest Gas Corporation (SGC) in Las Vegas. The closest point on the SGC distribution system is approximately 125 miles north-northwest of Ely in the Elko area. One of the alternative routes for the Rocky Mountain natural gas pipeline (the central Nevada alternative) could pass near Ely.

Home energy requirements in Ely are supplied by bottled gas, fuel oil, and electricity. Bottled gas, fuel oil, gasoline, and diesel fuel are trucked from bulk fuel handling terminals in Salt Lake City and Las Vegas to local distribution centers. The bottled gas (propane) is marketed locally by three companies - H&R Propane, CAL-Gas, and Turner Gas - and fuel oil, gasoline, and diesel fuel are distributed by local representatives of four major U.S. oil companies - Amoco, Chevron USA, Phillips 66, and Texaco. Increases in fuel demands would have to be met by expanding the present truck fleets, by adding new suppliers, by using military tanker trucks, or by extending natural gas and/or petroleum product pipelines into the area.

Table 3.3-1. (1986) Annual energy requirements - Alternative 2.

Use Category	Nevada P.O.L.[1] Gas 10^6 GA	Nevada P.O.L.[1] Diesel 10^6 GA	Nevada F.O.[2] 10^6 GA	Nevada Nat. Gas 10^6 CF	Nevada Electricity Demand MW	Nevada Electricity Use 10^3 MWH	Utah P.O.L.[1] Gas 10^6 GA	Utah P.O.L.[1] Diesel 10^6 GA	Utah F.O.[2] 10^6 GA	Utah Nat. Gas 10^6 CF	Utah Electricity Demand MW	Utah Electricity Use 10^3 MWH	Total P.O.L.[1] Gas 10^6 GA	Total P.O.L.[1] Diesel 10^6 GA	Total F.O.[2] 10^6 GA	Total Nat. Gas 10^6 CF	Total Electricity Demand MW	Total Electricity Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	26						16						42					
Support-Camps		3						2						5				
Support-Communities[3]			4		74	289			5		66	250			9		140	539
Bases																		
Equipment & Vehicles	1	1											1	1				
Commute & Recreation[3]	8						8						16					
Support-Camps		1						1						2				
Support-Communities[3]			1		21	83			1		17	64			2		38	147
Total	37	37	5		95	372	25	16	6		83	314	62	53	11		178	686
Operations																		
DDA		5			43	298					18	128		5			61	426
Bases																		
Technical Operation[3]s	1	10			14	38							1	10			14	38
Support-Onbase			3		47	100									3		47	100
Support-Offbase[3]			3		57	223					1	5			3		58	228
Commute & Recreation[3]	6												6					
Total	7	15	6		161	659					19	133	7	15	6		180	792

T5209/9-16-81/F

[1] P.O.L. - Petroleum, oils, and lubricants.

[2] F.O. - Fuel oils.

[3] Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.3-2. (1992) Annual energy requirements - Alternative 2.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA	1	10			80	558					34	240	1	10			114	798
Bases																		
Technical Operations	1	29			14	38							1	29			14	38
Support-Onbase			3		47	100			4		30	61			7		77	161
Support-Offbase[3]			1		12	47			1		13	51			2		25	98
Commute & Recreation[3]	21						16						37					
Total	23	39	4		153	743	16		5		77	352	39	39	9		230	1095

T5210/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.5-1. (1986) Annual energy requirements - Alternative 3.

Use Category	Nevada P.O.L.[1] Gas 10^6 GA	Nevada P.O.L.[1] Diesel 10^6 GA	Nevada F.O.[2] 10^6 GA	Nevada Nat. Gas 10^6 CF	Nevada Electricity Demand MW	Nevada Electricity Use 10^3 MWH	Utah P.O.L.[1] Gas 10^6 GA	Utah P.O.L.[1] Diesel 10^6 GA	Utah F.O.[2] 10^6 GA	Utah Nat. Gas 10^6 CF	Utah Electricity Demand MW	Utah Electricity Use 10^3 MWH	Total P.O.L.[1] Gas 10^6 GA	Total P.O.L.[1] Diesel 10^6 GA	Total F.O.[2] 10^6 GA	Total Nat. Gas 10^6 CF	Total Electricity Demand MW	Total Electricity Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	14						30						44					
Support Camps		3						2						5				
Support Communities[3]			7		109	431					58	218			11		167	649
Bases																		
Equipment & Vehicles							1	1					1	1				
Commute & Recreation[3]	3						4						7					
Support Camps		1						1						2				
Support Communities[3]			2		27	108					20	79			3		47	187
Total	19	36	9		136	539	36	17			78	297	55	53	14		214	836
Operations																		
DDA					43	298		5			18	128		5			61	426
Bases																		
Technical Operations							1	10			14	38	1	10			14	38
Support Onbase									5		42	87			5		42	87
Support Offbase[3]					5	18			3		32	123			3		32	141
Commute & Recreation[3]							5						5					
Total					48	316	6	15	8		106	376	6	15	8		154	692

E5211/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.4-2. (1992) Annual energy requirements - Alternative 3.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA					80	558	1	10			34	240	1	10			114	798
Bases																		
Technical Operations							1	29			14	38	1	29			14	38
Support-Onbase			5		28	56			4		42	87			9		70	143
Support-Offbase[3]			1		17	70			2		20	77			3		37	147
Commute & Recreation[3]	14						18						32					
Total	14		6		125	684	20	39	6		110	442	34	39	12		235	1126

T5212/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Electrical energy is supplied to the Ely area by Mount Wheeler Power, Inc. (MWP), a rural electric cooperative. Mount Wheeler Power has no generating facilities and relies on purchased power transmitted from other utilities via transmission lines. Because the transmission line capacity in the Ely area is presently limited, the availability of transmission lines to meet the M-X time and capacity requirements is a matter requiring attention.

The estimated electrical load increase in the Ely area due to an M-X base and the associated area population increase, is about 45 MW. The present Mount Wheeler Power system peak is approximately 25 MW.

The only principal bulk-power transmission line in the Ely area, Sierra Pacific's 230 kV line is operating at capacity and cannot be utilized to serve the increased load due to M-X. New transmission lines are currently being planned for the area in connection with the IPP generating plant in Utah and White Pine generating plant in White Pine County, Nevada. However, because current schedules indicate that these transmission lines will not be available prior to 1986, there is concern about financing new transmission facilities to meet M-X requirements prior to 1986. Assistance from the federal government may be requested by MWP in this regard, both in constructing new transmission facilities and in scheduling bulk-power to meet M-X requirements.

3.5 ALTERNATIVE 4 - BERYL; COYOTE SPRING VALLEY

Alternative 4 is located in the Nevada/Utah region with a First Base at Beryl, Utah and a Second Base at Coyote Spring Valley, Nevada. Energy requirements for construction and operation 1986 are present in Table 3.5-1 and for operation 1992 are presented in Table 3.5-2. The energy requirements are somewhat similar to that of the Proposed Action and Alternative 1 in which the operating bases are reversed, with the First Base at Coyote Spring. This is because of the larger population and greater number of facilities associated with the First Base, and because Beryl is colder during the winter than Coyote Spring Valley. The energy supply situations have been described in the Proposed Action for Coyote Spring Valley and in Alternative 1 for Beryl.

3.6 ALTERNATIVE 5 - MILFORD; ELY

Alternative 5 is located in the Nevada/Utah region with a First Base at Milford, Utah and a Second Base at Ely, Nevada. Energy requirements for construction and operation (1986) are presented in Table 3.6-1 and for operation (1992) are presented in Table 3.6-2. The energy supply situations have been described in the Proposed Action for Milford and in Alternative 3 for Ely.

3.7 ALTERNATIVE 6 - MILFORD; COYOTE SPRING VALLEY

Alternative 6 is located in the Nevada/Utah region with a First Base at Milford, Utah and a Second Base at Coyote Spring Valley, Nevada. Energy requirements for construction and operation (1986) are presented in Table 3.7-1 and for operation (1992) are presented in Table 3.7-2. The energy supply situation is the same as described for the Proposed Action, since the operating bases are located at the same locations.

Table 3.5.1. (1986) Annual energy requirements - Alternative 4.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	3					3	45				
Commute & Recreation[3]	13						30						43					
Support Camps		3						2						5				
Support Communities[3]			5		85	333			4		54	205			9		139	538
Bases																		
Equipment & Vehicles							1	1					1	1				
Commute & Recreation[3]	4						4						8					
Support Camps		1						1						2				
Support Communities[3]			2		36	140			1		19	74			3		55	214
Total	19	36	7		121	473	36	7	5		73	279	55	53	12		194	752
Operations																		
DDA					43	298		5			18	128		5			61	426
Bases																		
Technical Operations							1	10			14	38	1	10			14	38
Support Onbase									5		42	87			5		42	87
Support Offbase[3]			1		10	39			2		32	124			3		42	163
Commute & Recreation[3]							6						6					
Total			1		53	337	7	15	7		106	377	7	15	8		159	714

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[1] P.O.L. = Petroleum, oils, and lubricants.

[2] F.O. = Fuel oils.

[3] Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

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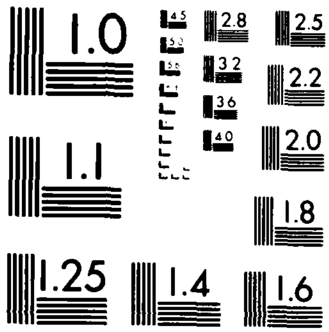

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Table 3.5-2. (1992) Annual energy requirements - Alternative 4.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA					80	558	1	10			34	240	1	10			114	798
Bases																		
Technical Operations							1	29			14	38	1	29			14	38
Support-Onbase			5		33	70			2		42	87			7		75	157
Support-Offbase[3]			1		11	43			1		20	79			2		31	122
Commute & Recreation[3]	15						18						33					
Total	15		6		124	671	20	39	3		110	444	35	39	9		234	1115

T5214/9-16-81/F

[1]P.O.L. = Petroleum, oils, and lubricants.
[2]F.O. = Fuel oils.
[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.6-1. (1986) Annual energy requirements - Alternative 5.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	14						30						44					
Support-Camps		3						2						5				
Support-Communities[3]			7		109	430			4		63	237			11		172	667
Bases																		
Equipment & Vehicles							1	1					1	1				
Commute & Recreation[3]	3						8						11					
Support-Camps		1						1						2				
Support-Communities[3]			2		24	99			2		21	83			4		45	182
Total	19	36	9		133	529	40	17	6		84	320	59	53	15		217	849
Operations																		
DDA					43	298		5			18	128		5			61	426
Bases																		
Technical Operations							1	10			14	38	1	10			14	38
Support-Onbase									5		42	87			5		42	87
Support-Offbase[3]					2	8			2		29	111			2		31	119
Commute & Recreation[3]							6						6					
Total					45	306	7	15	7		103	364	7	15	7		148	670

T5215/9-16-81/F

[1] P.O.L. - Petroleum, oils, and lubricants.

[2] F.O. - Fuel oils.

[3] Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.6-2. (1992) Annual energy requirements – Alternative 5.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA					80	558	1	10			34	240	1	10			114	798
Bases																		
Technical Operations							1	29			14	38	1	29			14	38
Support–Onbase			5		33	56			4		42	87			9		75	143
Support–Offbase[3]			1		14	57			2		24	93			3		38	150
Commute & Recreation[3]	14						19						33					
Total	14		6		127	671	21	39	6		114	458	35	39	12		241	1129

T5216/9-16-81/F

[1]P.O.L. = Petroleum, oils, and lubricants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.7-1. (1986) Annual energy requirements - Alternative 6.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	2	32					1	13					3	45				
Commute & Recreation[3]	18						26						44					
Support-Camps		3						2						5				
Support-Communities[3]			5		86	335			4		59	223			9		145	558
Bases																		
Equipment & Vehicles							1	1					1	1				
Commute & Recreation[3]	8						8						16					
Support-Camps		1						1						2				
Support-Communities[3]			2		33	130			1		20	79			3		53	209
Total	28	36	7		119	465	36	17	5		79	302	64	53	12		198	767
Operations																		
DDA					43	298		5			18	128		5			61	426
Bases																		
Technical Operations							1	10			14	38	1	10			14	38
Support-Onbase									5		42	87			5		42	87
Support-Offbase[3]					7	27			2		29	113			2		36	140
Commute & Recreation[3]							6						6					
Total					50	325	7	15	7		103	366	7	15	7		153	691

T5217/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.7-2. (1992) Annual energy requirements - Alternative 6.

Use Category	Nevada						Utah						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA					80	558	1	10			34	240	1	10			114	798
Bases																		
Technical Operations							1	29			14	38	1	29			14	38
Support-Onbase			5		33	70			2		42	87			7		75	157
Support-Offbase[3]					8	31			2		24	95			2		32	126
Commute & Recreation[3]	15						19						34					
Total	15		5		121	659	21	39	4	111	114	460	36	39	9		235	1,119

T5218/9-16-81/F

[1]P.O.L. = Petroleum, oils, and lubricants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

3.8 ALTERNATIVE 7 - CLOVIS; DALHART

Alternative 7 is located in the Texas/New Mexico region with a First Base at Clovis, New Mexico and a Second Base at Dalhart, Texas. Energy requirements for construction and operation (1986) are presented in Table 3.8-1 and for operation (1992) are presented in Table 3.8-2.

ELECTRIC POWER (3.8.1)

Designated Deployment Area (DDA)

A substantial transmission and distribution system exists in Region 22 of the Southwest Power Pool. These facilities could be utilized to serve M-X, minimizing the need for new line construction. However, some new and upgraded lines would still be required. The actual amount of construction cannot be determined until a detailed layout for the M-X is developed and the Southwest Power Pool planning studies are completed.

First Base: Clovis

Electrical energy is supplied to Clovis by Southwestern Public Service Company (SWPS) via two 115 kV transmission lines. The present 10 MW electrical load at Cannon AFB is supplied by SWPS via a 69 kV transmission line from Clovis.

The estimated electrical load increase in the Clovis area due to an M-X base and the corresponding population increase is 72 MW. This additional load might be supplied by upgrading the existing line or constructing new transmission facilities.

The increased electrical load due to a base, and the associated population increase at Clovis or Dalhart, would not represent a major impact to SWPS.

Second Base: Dalhart

Electrical energy is supplied to Dalhart by Southwestern Public Service Company via a 115 kV transmission line and a 69 kV transmission line. The present peak electrical demand of Dalhart is approximately 30 MW. The estimated electrical load increase in the Dalhart area due to a base and the associated population increase is 56 MW.

FUEL SUPPLY (3.8.2)

Designated Deployment Area (DDA)

As previously discussed, there are numerous pipelines carrying crude oil, refined products, and natural gas within the Texas/New Mexico area.

First Base: Clovis

The Clovis base is located in an area served by the Gas Company of New Mexico, a subsidiary of Southern Union Gas Company, Dallas. Gas supplies throughout the area appear to be excellent, and the increased natural gas demand could be met without major problems if adequate lead time is allowed to construct

Table 3.8-1. (1986) Annual energy requirements - Alternative 7.

Use Category	Texas						New Mexico						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	1	18					1	16					2	34				
Commute & Recreation[3]	13						12						25					
Support-Camps		3						2						5				
Support-Communities[3]				443	72	283				233	38	151				666	110	434
Bases																		
Equipment & Vehicles																		
Commute & Recreation[3]	6						5						11					
Support-Camps		1						1						2				
Support-Communities[3]				91	15	59				90	15	58				181	30	117
Total	20	22		524	87	342	18	19		323	53	209	38	41		847	140	551
Operations																		
DDA					32	226		5			29	200		5			61	426
Bases																		
Technical Operations							1	10			14	38	1	10			14	38
Support-Onbase										500	43	97				500	43	97
Support-Offbase[3]				7	1	5				158	26	102				165	27	107
Commute & Recreation[3]							3						3					
Total				7	33	231	4	15		658	112	437	4	15		665	145	668

T5219/9-16-81/F

[1]P.O.L. = Petroleum, oils, and lubricants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.8-2. (1992) Annual energy requirements - Alternative 7.

Use Category	Texas						New Mexico						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Operations																		
DDA					60	423	1	10			54	375	1	10			114	798
Bases																		
Technical Operations							1	29			14	38	1	29			14	38
Support-Onbase				360	30	69				500	43	97				860	73	166
Support-Offbase[3]				156	26	102				89	15	57				245	41	159
Commute & Recreation[3]	16						10						26					
Total	16			516	116	594	12	39		589	126	567	28	39		1105	242	1161

T5220/9-16-81/F

[1]P.O.L. = Petroleum, oils, and lubricants.

[2]F.O. = Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

any required facilities. Petroleum product and crude oil pipelines traverse the Clovis area. Fuel supplies are excellent and no major problems should be encountered.

Second Base: Dalhart

The Dalhart area is served by Pioneer Natural Gas Company of Amarillo and by Peoples Natural Gas. Because Dalhart is located in a major gas producing area, natural gas supplies are excellent and the increased demands could be handled without major problems if adequate lead time is allowed to construct any required facilitites. Because a large petroleum refining center is located approximately 75 mi southeast of Dalhart at Amarillo, petroleum product supplies should be adequate to supply the increased fuel demand.

3.9 ALTERNATIVE 8 - COYOTE SPRING VALLEY; CLOVIS

Alternative 8 is a split basing mode with part of the system located in Nevada/Utah with a First Base in Coyote Spring Valley, Nevada and part of the system located in Texas/New Mexico with a Second Base in Clovis, New Mexico. Energy requirements for construction and operation 1986 are presented in Table 3.9-1, and operation1992 are presented in Table 3.9-2. The energy supply situations have been discussed for Coyote Spring Valley in the Proposed Action and for Clovis in Alternative 7.

Table 3.9-1. (1986) Annual energy requirements - Alternative 8 (Page 1 of 2).

Use Category	Nevada P.O.L.[1] Gas 10^6 GA	Nevada P.O.L.[1] Diesel 10^6 GA	Nevada P.O.L.[1] F.O.[2] 10^6 GA	Nevada Nat. Gas 10^6 CF	Nevada Electricity Demand MW	Nevada Electricity Use 10^3 MWH	Utah P.O.L.[1] Gas 10^6 GA	Utah P.O.L.[1] Diesel 10^6 GA	Utah P.O.L.[1] F.O.[2] 10^6 GA	Utah Nat. Gas 10^6 CF	Utah Electricity Demand MW	Utah Electricity Use 10^3 MWH
Construction												
DDA												
Equipment & Vehicles	1	14						10				
Commute & Recreation[3]	9						6					
Support-Camps		2						1				
Support-Communities[3]			4		56	221			2		31	118
Bases												
Equipment & Vehicles	1											
Commute & Recreation[3]	8											
Support-Camps		1										
Support-Communities[3]			1		16	61						
Total	19	17	5		72	282	6	11	2		31	118
Operations												
DDA		3			21	145					10	68
Bases												
Technical Operations	1	6			14	38						
Support-Onbase			3		47	100						
Support-Offbase[3]			3		49	191			1			
Commute & Recreation[3]	6											
Total	7	9	6		131	474			1		10	68

T5221/9-16-81/F

Table 3.9-1. (1986) Annual energy requirements - Alternative 8 (Page 2 of 2).

Use Category	Texas						New Mexico						Total					
	P.O.L.[1]				Electricity		P.O.L.[1]				Electricity		P.O.L.[1]				Electricity	
	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH	Gas 10^6 GA	Diesel 10^6 GA	F.O.[2] 10^6 GA	Nat. Gas 10^6 CF	Demand MW	Use 10^3 MWH
Construction																		
DDA																		
Equipment & Vehicles	1	10						3					2	37				
Commute & Recreation[3]	1						4						20					
Support-Camps		1						2						6				
Support-Communities[3]				116	19	76				248	41	161			6	364	147	576
Bases																		
Equipment & Vehicles	1												2					
Commute & Recreation[3]							3						11					
Support-Camps								1						2				
Support-Communities[3]				19	3	12				126	21	82			1	145	40	155
Total	3	11		135	22	88	7	16		374	62	243	35	45	7	509	187	731
Operations																		
DDA					11	77		3			19	136		6			61	426
Bases																		
Technical Operations								6					1	12			14	38
Support-Onbase															3		47	100
Support-Offbase[3]										11	2	7			4	11	51	198
Commute & Recreation[3]													6					
Total					11	77		9		11	21	143	7	18	7	11	173	762

T5221/9-24-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

Table 3.9-2. (1992) Annual energy requirements — Alternative 8 (Page 1 of 2).

Use Category	Nevada P.O.L.[1] Gas 10^6 GA	Nevada P.O.L.[1] Diesel 10^6 GA	Nevada P.O.L.[1] F.O.[2] 10^6 GA	Nevada Nat. Gas 10^6 CF	Nevada Electricity Demand MW	Nevada Electricity Use 10^3 MWH	Utah P.O.L.[1] Gas 10^6 GA	Utah P.O.L.[1] Diesel 10^6 GA	Utah P.O.L.[1] F.O.[2] 10^6 GA	Utah Nat. Gas 10^6 CF	Utah Electricity Demand MW	Utah Electricity Use 10^3 MWH
Operations												
DDA	1	5			39	271					18	128
Bases												
Technical Operations	1	50			14	38						
Support—Onbase			3		47	100						
Support—Offbase[3]			1		13	51						
Commute & Recreation[3]	23											
Total	25	55	4		113	460					18	128

T5222/9-16-81/F

Table 3.9-2. (1992) Annual energy requirements — Alternative 8 (Page 2 of 2).

Use Category	Texas: P.O.L.[1] Gas 10^6 GA	Texas: P.O.L.[1] Diesel 10^6 GA	Texas: F.O.[2] 10^6 GA	Texas: Nat. Gas 10^6 CF	Texas: Electricity Demand MW	Texas: Electricity Use 10^3 MWH	New Mexico: P.O.L.[1] Gas 10^6 GA	New Mexico: P.O.L.[1] Diesel 10^6 GA	New Mexico: F.O.[2] 10^6 GA	New Mexico: Nat. Gas 10^6 CF	New Mexico: Electricity Demand MW	New Mexico: Electricity Use 10^3 MWH	Total: P.O.L. Gas 10^6 GA	Total: P.O.L. Diesel 10^6 GA	Total: F.O.[2] 10^6 GA	Total: Nat. Gas 10^6 CF	Total: Electricity Demand MW	Total: Electricity Use 10^3 MWH
Operations																		
<u>DDA</u>		5			20	144					37	255	1	10			114	798
<u>Bases</u>																		
Technical Operations											12	34	1	50			26	72
Support—Onbase										390	31	70			3	390	78	170
Support—Offbase[3]				26	4	17				93	15	61			1	119	32	129
Commute & Recreation[3]							8						31					
Total		5		26	24	161	8			483	95	420	33	60	4	509	250	1,169

T5222/9-16-81/F

[1]P.O.L. - Petroleum, oils, and lubricants.

[2]F.O. - Fuel oils.

[3]Includes M-X induced population (direct and indirect) energy needs.

Source: HDR Sciences, 1981.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 REGIONS OF INFLUENCE

Potential impacts on biological, natural and sociocultural resources associated with meeting M-X system energy requirements may be local utility, area wide, or regional depending on the size of the electrical utilities service area, the fuel and natural gas suppliers, and their regional associations (see Table 4.1-1).

ELECTRICAL POWER (4.1.1)

The Nevada/Utah deployment region is served by several electrical utilities, each with its own distinct franchise area. The Milford area is served by Utah Power & Light, which generates, transmits, and sells power, often in bulk quantities. The Beryl and Coyote Spring areas are served by small utilities which purchase power and distribute it to local consumers. The utilities have joined together in the Western System Coordinating Council (WSCC) to coordinate transfers of bulk power throughout the region and various subregions. The Intermountain Consumers Power Association is a group of utilities which are cooperating in building new generating facilities, specifically the 3000 Mw Intermountain Power Project (IPP).

The Texas/New Mexico region is served by the Southwestern Public Service Company (SPSC), which is part of the Southwest Power Pool (SPP). The Western Area Power Administration (WAPA) is responsible for marketing power (principally hydroelectric) produced by federal agencies. The utilities have formed an M-X System Transmission Coordinating Council with a spokesman from Nevada Power Company to coordinate with the Air Force on M-X requirements (see Appendix A).

FUEL SUPPLY (4.1.2)

The region of influence associated with major fuel and natural gas suppliers is presented in Table 4.1-1. Only Clovis has a refinery nearby (in Amarillo). Liquid fuels for Nevada/Utah would come principally through Las Vegas or Salt Lake City. The proposed Rocky Moutain Pipeline (RMP), a 36-in., high pressure gas transmission line, from southwest Wyoming to southeast California would pass through the study area east of Milford and Beryl. An alternate route paralleling U.S.6/50 and would pass near Ely, Nevada. Since RMP would be only a transporter of natural gas, its participants would arrange for purchase of a gas supply and local distribution.

4.2 POTENTIAL IMPACTS

Potential impacts of M-X energy requirements include the following:

- Possible shortages and price increases caused by M-X requirements for electrical power, petroleum products, and natural gas above projected baseline supplies during M-X construction and/or operation.
- Daily or seasonal variations in M-X requirements which may have additional impacts on available supplies or transmission, transportation, and storage capabilities.

Table 4.1-1. Region of influence for energy supplies.

Alternatives	OB Location	Region of Influence	Electricity	Liquid Fuels	Natural Gas
1,3,4	Beryl, UH	Local	Dixie-Escalante REA City of St. George	---	---
		Larger Area	Intermountain Consumers Power Association	St. George, Cedar City	Mountain Fuel Supply Southwest Cas (of Nevada)
		Regional	WSCC, WAPA	Las Vegas, Salt Lake City	Pacific Gas Transmission
2	Delta, UT	Local			
		Larger Area	Utah Power & Light Company	"	Mountain Fuel Supply
		Regional	WSCC, WAPA	"	Pacific Gas Transmission
PA,2,4,6,8	Coyote Spring, NV	Local	Lincoln County Power District	---	---
		Larger Area	Nevada Power Company	CAL-NEV Pipeline Co.	Southwest Gas Corp.
		Regional	WSCC, WAPA	Las Vegas	Las Vegas
3, 5	Ely, NV	Local	Mount Wheeler Power		
		Larger Area	Sierra Pacific		Southwest Gas Corp.
		Regional	WSCC, WAPA	Las Vegas, Salt Lake City	Las Vegas
PA,5,6	Milford, UT	Local	---	---	---
		Larger Areas	Utah Power & Ligh Company	St. George, Cedar City	Mountain Fuel Supply
		Regional	WSCC, WAPA	Las Vegas, Salt Lake City	Pacific Gas Transmission
7	Dalhart, TX	Local		---	
		Larger Area	SPSC	Amarillo	Pioneer Nat. Gas Co. Peoples Nat. Gas
		Regional	SPP	---	
7,8	Clovis, NM (Cannon AFB)	Local		Southern Union Refining Co.	Gas Company of New Mexico
		Larger Area	SPSC	Amarillo	El Paso Nat. Gas Co.
		Regional	SPP	---	Southern Union Gas Co.

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Source: HDR Sciences, 1981.

- o Possible interference with other energy projects, such as power plants, transmission lines, pipelines, coal and uranium mining, geothermal development, and synfuels projects. Interference could include siting conflicts and competition for resources, such as water, labor force, and construction materials.

- o Air, land, and water pollution from increased combustion of fossil fuels, whether in a centralized facility for each operating base, or in dispersed systems. Table 4.2-1 presents typical pollutants which are associated with potentially available fuels. As a comparison, M-X electrical energy requirements would be approximately equivalent to one 250 Mw unit of the new North Valmy station in north central Nevada, which is being constructed by Sierra Pacific and Idaho Power.

- o Environmental impacts concerning potential land use conflicts, scenic resources, and biological resources which are associated with several hundred miles of high voltage transmission lines (Table 4.2-2), and stand-off distances required from M-X facilities for future transmission lines (Table 4.2-3).

4.3 ENERGY SUPPLY - NEVADA/UTAH

ELECTRIC POWER (4.3.1)

Regionally, the induced effect of M-X on the total energy scene is relatively minor (Table 4.3-1). The proposed White Pine Power Project and IPP project will facilitate growth in the region. Potential site-specific impacts to the biological natural and socioeconomic resources are related to transmission line construction and the possible upgrading of utilities to meet operating base requirements. All of the proposed transmission lines are routed in close proximity to the alternative proposed operating base locations. Additional transmission lines and substations will have to be constructed to serve the operating bases.

The utilities that would be affected by M-X development do not at this time have the capacities in their existing transmission line system to serve M-X needs. Proper pre-planning to upgrade the systems is needed to increase the load carrying capacities in transmission lines in time to accommodate M-X development. The utilities have asked for a lead time of up to 4 to 5 years, to assure that their systems will be capable of serving the M-X development (see Appendix A). New energy facilities will be phased into use as they come on line.

FUEL SUPPLY (4.3.2)

The effect of M-X development could cause the natural gas companies in the Nevada region to extend service into the proposed deployment areas. Proper pre-planning and commitment from the Air Force and gas companies will be required to assure adequate and timely fuel supplies.

Other fuels (i.e., gas and diesel) will have to be reevaluated for increased requirements due to M-X construction and operations. During the construction phase, bottled gas, diesel, gasoline, and fuel oil requirements will increase (Table 4.3-2). Truck fleets will also increase, and distribution centers will be required to support M-X construction.

Table 4.2-1. Principal pollutants by fuel and environmental area.

Fuel Pollutants	Environmental Area Pollutants: Air	Water	Land
Natural Gas	Sulfur Oxides Particulates Nitrogen Oxides Carbon Monoxide Hydrocarbons Flared Gases	Production Liquids	Drilling Muds
Nuclear	Radiation	Radiation Suspended Solids Iron Maganese Acidity Nickel Zinc	Mining Slag Milling Slag
Hydroelectric		Silt	Inundation of Pond Area
Oil	Particulates Sulfur Oxides Nitrogen Oxides Carbon Monoxide Hydrocarbons Flared Gases	Production Liquids Refinery Waste Water Refinery Generated Toxic and Hazardous Substances	Drilling Muds Refinery Generated Toxic and Hazardous Substances
Coal	Particulates Sulfur Oxides Nitrogen Oxides Carbon Monoxide Organics Radionuclides	Waste Waters Suspended Solids Iron Maganese Nickel Zinc	Mining Slag Cleaning and Preparation Plant Slag Fly and Bottom Ash Scrubber Sludge

T5182/9-14-81/F

Sources: DOE/EPA, Energy/Environment Fact Book; DOE/EIA-0201/12, August 1980, Government Actions Affecting the Environment and Their Effect on Energy Markets.

Table 4.2-2. Preliminary estimates for high voltage transmission (HVT) line requirements.

Type	Voltage	Miles	
		Nevada/Utah (Alternatives 1-6)	Texas/New Mexico (Alternative 7)
Transmission	230-345 kV	300	100
Subtransmission	138-230 kV	800	400
Primary Distribution	35-69 kV	1,800	1,200
Total		2,900	1,700

T5183/9-18-81

Source: HDR Sciences, 1981.

Table 4.2-3. Preliminary standoff distances for powerlines and power generating facilities.

The distance from the shelter/CMF operating base technical facilities/DAA site fences to power facilities shall be as follows:

Separation Distance (ft)	kV Rating
750	Less than 50
1250	50 to 250
2500	250 or more

T5184/9-14-81/F

Justification: The above M-X facilities must be isolated from sources of electromagnetic energy which could impact the M-X system capability due to susceptibility to such energy. (Radios.)

Source: BMO "Siting Criteria for M-X Designated Deployment Area" (10 November 1980).

Table 4.3-1. Comparison of M-X electrical energy needs with national and regional use.

	Electrical Power Demand		Electrical Energy Consumption	
	(MW)	M-X Construction/ Operations (as %)	(10^3 MWH)	M-X Construction/ Operations (as %)
Contiguous U.S. (Summer 1986)	513,984	0.07	2,833,967	0.05
M-X Needs: Preferred Alternative (Nevada/Utah)				
Construction/operations (1986)	359	100	1,480	100
Operations (1992)	234	153	1,115	133
WSCC Region (Summer 1986)	90,796	0.4	553,641	0.27
Nevada Production (1978)	--	--	12,940	--
Utah Production (1978)	--	--	8,627	--
Total (Nevada & Utah)	--	--	21,567	6.8
Contiguous U.S. (Summer 1986)	513,984	0.05	2,833,967	0.04
M-X Needs: Alternative				
(Texas/New Mexico)				
Construction/operations (1986)	285	100	1,219	100
Operations (1992)	241	118	1,161	105
SPP Region (Summer 1986)	53,918	0.5	264,389	0.46
Texas Production (1978)	--	--	184,054	--
New Mexico Production (1978)	--	--	19,577	--
Total (Texas & New Mexico)	--	--	203,631	0.6

T5392/9-17-81

Sources: DOE-EP-0022 "Electric Power Supply and Demand for the Contiguous United States, 1981-1990" (July 1981); Western Systems Coordinating Council - "Coordinated Bulk Power Supply Program" 1980-1990 (April 1, 1981); Southwest Power Pool - "Coordinated Bulk Power Supply Program" (April 1, 1980); DOE/EIA - 0049 (75) Energy Data Report - "Power Production, Fuel Consumption, and Installed Capacity Data for 1975 (Final)" (June 12, 1980); Table 2.2-1; Table 2.2-2.

4.4 ENERGY SUPPLY - TEXAS/NEW MEXICO

ELECTRIC POWER (4.4.1)

The Texas/New Mexico region interfaces with an abundant network of power transmission lines. Some of the lines will have to be upgraded to support the increased load to site-specific areas. The impact on biological and natural resources resulting from construction and operation of any additional transmission and distribution facilites may be mitigated by the use of existing or established corridors where feasible.

FUEL SUPPLY (4.4.2)

The Texas/New Mexico siting region is located in the proximity of energy producing resources. Natural gas is available for all of the proposed operating sites and can be used to facilitate all heating requirements. The largest impact on the region will not be on energy availability but rather its possible effect of cluster siting on the large network of pipelines between Hereford, Texas and Clayton, New Mexico. The M-X system layouts presented in this FEIS are conceptual and more detailed siting studies that address potential conflicts with utilities will be developed.

4.5 EFFECT ON ENERGY SYSTEMS NEAR OPERATING BASES

BERYL, UTAH AREA (4.5.1)

The effect of construction and operation of the M-X system for Alternatives 3 and 4 (First Base), and Alternative 1 (Second Base) at Beryl, Utah, will require improvements in energy capabilities for the area.

Electric Power

The estimated electrical load increase in the Beryl area due to operation of the M-X operating base and anticipated population increase is about 73 Mw for a First Base and 42Mw for a Second Base. The present Dixie-Escalante system peak demand is 20 Mw, this increase in electrical load will have a substantial impact on the transmission of electricity in the area. One or more transmission lines into Beryl would have to be constructed to serve the M-X system, and new substations and distribution facilities would also be required.

Dixie-Escalante is a member of the Intermountain Consumers Power Association and is a participant in the Moon Lake, Hunter, and Intermountain Power Project (IPP) generating plant projects. A potential conflict in land use exists between the proposed IPP transmission line routing and the conceptual operating base location. Refer to ETR-1 for a description of this land use conflict. Representatives of Dixie-Escalante indicate that the bulk-power requirements of the M-X base can be met if a sufficiently early and definite commitment is made by the Air Force to permit scheduling of power.

Petroleum Products

The only type of fuel oil presently produced in significant quantities in Utah is No. 2 diesel. No No. 6 oil is produced because of the heavy demand for JP-4 jet fuel with is produced from the same feedstock. Diesel fuel supplies can probably be made available to meet the heating and cooling requirements of the operational base, and to partially meet the requirement of a cogeneration plant. The diesel fuel could either be trucked in or brought in by railroad on the Union Pacific Railroad Line. Other types of petroleum products would be obtained from suppliers in the Las Vegas and/or Salt Lake City areas.

Natural Gas

At present there is no natural gas service at the proposed Beryl, Utah site. Utah is supplied by the Mountain Fuel Supply Company. Large reserves have been discovered and are being developed in Wyoming and delivered through its distribution system. The nearest existing transmission pipeline that could serve the Base's requirements is at Nephi, Utah. Costs of extending a pipeline are borne directly by the customer requesting the extension. Estimating pipeline extension costs is difficult because of the many variables involved, but costs would be considerable.

Mountain Fuel Supply Company has potential customers in the Beryl area and could extend their service to the area for those customers and the M-X community.

Pacific Gas Transmission has proposed, and is scheduled for 1982 construction, a long distance natural gas transmission line which could pass very close to the proposed Beryl Base. This transmission line, the Rocky Mountain Pipeline, will stretch from the Greater Green River Basin and the Overthrust Belt in the Rocky Mountains to California. Latest estimates place gas service commencing in this pipeline as sometime in 1985. The line will be 36 in. in diameter with an initial flow capacity of 413 million cubic feet per day. The addition of more compressor stations could increase the flow to a maximum of 800 million cubic feet per day.

The capacity of this pipeline has not yet been committed. While the pipeline should have the additional capacity to handle the gas capacity of the proposed Beryl site, the availability of the gas for use is not assured. In order for the proposed Beryl Base to utilize the gas handling capacity of the Rocky Mountain Pipeline, it would be necessary to contract for the gas supplied and for a tap off the main pipeline with either Mountain Fuel Supply Company or Southwest Gas Company.

Coal

Coal is in ample supply, at low cost, when compared to electricity, natural gas, or oil, as a fuel source. Coal resources will not be exhausted in the foreseeable future.

The state of Utah is one of the nation's largest coal producers with calendar year (CY) 1979 coal production at 12.9 million tons. This number is expected to increase, particularly with the coming on-line of the 3,000 megawatt Intermountain Power Project (IPP), which alone will annually consume 9 to 10 million tons of Utah

coal. Based upon U.S. Bureau of Mines figures, demonstrated coal reserves in Utah as of January 1, 1976 were:

Bituminous underground	6,283.8 million tons
Bituminous surface	267.9 million tons
Subbituminous underground	1.1 million tons

These facts, along with the relative proximity of the Beryl site to the Central Utah coal fields, make it highly likely that the coal burned at the Beryl site would be mined in Utah.

The vast majority of Utah coal presently mined, and that found in reserves, is of the type which must be mined underground as opposed to that which is extracted by stripmining.

The Beryl site is presently traversed by the Union Pacific Railroad (UPRR). A railroad span could be built to connect the proposed central plant and associated coal storage facilities to the railroad line. The UPRR is linked to the major coal producing regions of Utah.

CLOVIS, NEW MEXICO AREA (4.5.2)

The effect of construction and operation of M-X system for Alternatives 7 and 8 (First Base) at Clovis, New Mexico, will be minimal. Very few additional facilities will be required to handle the increased energy demands.

Electric Power

It is estimated that the increase in electrical load due to the operation of an M-X operating base and associated population increase would be about 72 Mw. This additional load could be supplied by upgrading the existing line or construction of new transmission facilities.

The increased electrical load due to the operating base and associated population increase in the area would not represent a major impact to Southwestern Public Service Company (SWPC). Planning, engineering, and construction of required transmission facilities could be handled by the SWPS main office. The bulk-power requirements can be readily supplied by SWPS.

Petroleum Products

Cannon Air Force Base receives all of its diesel fuel and about half of its JP-4 fuel from the Southern Union Refining Company. Southern Union has indicated that it can supply at least part of the fuel requirement for a Central Cooling and Heating Facility (CCHF).

The primary energy-related problem would be interferences between proposed M-X facilities, oil-producing fields, and pipelines systems. It is anticipated that this problem may eliminate a sizeable portion of the Texas/New Mexico region from consideration as potential sites for clusters.

Natural Gas

Clovis, New Mexico, including Cannon Air Force Base, currently receives natural gas service from the Gas Company of New Mexico. Base gas supply is provided though 6-in. main lines connected to a high-pressure, 6-in. Gas Company of New Mexico branch line running east-west, approximately 1 mi north of the base. This line connects with large 8 to 10-in. lines, which are supplied by El Paso Natural Gas.

A spokesman for the Gas Company of New Mexico indicated that gas is plentiful. Sufficient capacity exists on the 6-in high-pressure line to supply at least an additional 350 million cu ft/yr. to the current gas flow rate. This would be more than enough to meet the heating, and domestic hot water requirements of the OB. He also mentioned that the 8 and 10 in. feeder lines probably have enough additional capacity to meet the demands of a gas turbine cogeneration plant although this is presently being verified.

Coal

Coal is in ample supply at low cost when compared to electricity, natural gas, or oil, as a energy source. Coal resources will not be exhausted in the foreseeable future.

The state of New Mexico is one of the nation's largest coal producers, with CY 1979 coal production estimated at 12.9 million tons. This number has been steadily increasing since the late 1950s because of the availability of inexpensive strippable coal and growing power requirements in the southwest United States. Based upon U.S. Bureau of Mines figures, demonstrated coal reserves as of January 1, 1976, are the following:

Anthracite underground	2.3 million tons
Bituminous underground	1,258.8 million tons
Bituminous surface	601.1 million tons
Subbituminous underground	889.0 million tons
Subbituminous surface	1,846.8 million tons

Of the recent production figures given, all but about 800,000 tons are strip mined. All of the 800,000 tons not stripmined are used in producing coke for steelmaking. Most New Mexico bituminous coal is low sulfur (0.4-1.0 percent). The heating value of New Mexico coal is very much site dependent, ranging from 9,100 Btu/lb. for the lower quality Fruitland coal to 15,200 Btu/lb for the higher quality Mesaverde coals.

COYOTE SPRING VALLEY, NEVADA AREA (4.5.3)

The effect of construction and operation of the M-X system for the Proposed Action and Alternatives 1, 2 and 8 (First Base) and Alternatives 4 and 6 (Second Base) at Coyote Spring Valley, Nevada will require improvements in energy transportation capabilities. In addition, development of required energy generating facilities must be in concert with M-X system development.

Electric Power

The electrical load increase in the Coyote Spring Valley area due to operation of the M-X operating base and associated area population increase would be approximately 71 Mw for a First Base and 44 Mw for a Second Base. Lincoln County Power District, which serves the area, has a present peak service capacity of 16 Mw. The increase in electrical load will have significant impact on power availability primarily because of the limited transmission capability of the existing distribution system.

Discussions with Lincoln County Power District and Nevada Power Company to determine the most expeditious way of serving the M-X system are in progress. Both companies will cooperate in the planning, engineering, and construction of transmission facilities.

Fuel

To meet the demand for fossil fuels due to M-X development, natural gas lines could be extended into the area by Southwest Gas Corporation. There are presently no plans for such an extension of lines into the area.

DALHART, TEXAS AREA (4.5.4)

The effect of construction and operation of the M-X system with Dalhart, Texas as a Second Base in Alternative 7, will be minimal. Very few additional facilities will be required to handle the increased energy demand.

Electric Power

It is estimated that the increase in electrical load due to an operating base and associated population increase would be approximately 56 Mw. Since this is an increase in load, some new transmission and distribution facilities will be required.

The increased electrical load due to the operating base would not represent a major impact to SWPS. Planning, engineering, and construction of required transmission facilities would be handled by the SWPS main office. The bulk-power requirements can be readily supplied by the SWPS.

Fuel

The primary energy-related problem will be the interferences between proposed M-X facilities, energy-producing fields, and pipeline systems.

DELTA, UTAH AREA (4.5.5)

The effect of construction and operation of the M-X system for Alternative 2, with the second operation base at Delta, Utah will require substantial improvements in energy transportation capabilities. Development of required energy handling systems must be in concert with M-X system construction.

Electric Power

The estimated electrical load increase in the Delta area due to operation of the M-X operating base and associated population increases would be approximately 44 MW. The present electrical load at Delta, Utah is 6 MW. Because this is a substantial increase over the present load, new transmission and distribution facilities will be required.

Delta is served by Utah Power and Light, which presently has a 2,700 MW load capacity and is a major partner in the development of the IPP project. UPL has the planning, engineering and construction capabilities to construct the required new facilities.

Fuel

Induced service due to M-X development and the development of the IPP Power Plant could increase the demand for construction of the PGT natural gas line.

ELY, NEVADA AREA (4.5.6)

The effects of construction and operation of the M-X system for Alternatives 3 and 5, with the second operating base at Ely, Nevada, will require improvements in energy transportation capabilities.

Electric Power

The estimated electrical load increase in the Ely area due to operation of the M-X operating base and the associated area population increase would be about 45 MW. The present Mount Wheeler Power (MWP) system peak is approximately 25 MW. Because this is a substantial increase over the present load, new transmission and distribution facilities would be required.

As a rural cooperative, MWP can get a loan from the rural electrification administration. However, the rate payers in the MWP service area have to repay construction loans. The federal government could provide financial assistance for the construction of new 230 KV lines to minimize economic impact on MWP users and to accelerate construction of new lines to bridge the gap between power needs in 1984 and 1986.

Fuel

To meet the demand for fossil fuels due to M-X development, natural gas lines could be extended into the area by the Southwestern Gas Corporation. There are presently no plans for such an extension into the area.

MILFORD, UTAH AREA (4.5.7)

The effect of construction and operation of the M-X system for Alternatives 5 and 6 (First Base) and for the Proposed Action (Second Base) at Milford, Utah will require improvements in energy capabilities for the area.

Electric Power

The estimated electrical demand for the Milford area is about 80 MW for a First Base and 47 MW for a Second Base. Presently, Milford has a load of approximately 5 MW and is supplied by two 46 kV lines. Because this is a substantial increase over the present load, new transmission and distribution facilities would be required.

Construction of new transmission and distribution facilities, as required to serve the operating base, could be constructed by Utah Power and Light.

The bulk-power requirements for the operating base and associated area population increase are significant and need to be scheduled early. Typical plant construction time is 3 years from ground breaking to on-line, and normal planning lead time is 4 to 5 years from identification of requirements to completion of major facilities.

Fuel

The fuel supply scenarios for petroleum products, natural gas, and coal described above for the Beryl, Utah area are also applicable to the Milford, Utah area.

5.0 MITIGATIONS

5.1 MITIGATION POLICIES

Planning for M-X facilities is proceeding with the following goals and objectives relative to energy production, transmission, and consumption:

- o Make optimal use of energy-efficient concepts, systems, and technologies.
- o Make optimal use of renewal energy resources and systems (RES).
- o Minimize air, water, and noise pollution.
- o Incorporate conservation systems.
- o Minimize energy expenditures.

The Air Force will utilize conservation measures and alternative and renewable energy resources whenever possible. The Air Force will also site facilities to minimize energy use, develop an energy monitoring and control system for the operating bases, and coordinate with local utilities.

5.2 BASE COMPREHENSIVE PLANNING

A Base Comprehensive Plan (BCP) is being developed to make optimal use of the latest developments in energy-efficient concepts, systems, and technologies. Land Use Plans for potential Operating Base locations (Coyote Spring, Beryl, Milford, and Clovis-Cannon AFB) are being prepared in accordance with the following energy conservation guidelines (EDAW, Inc., 30 April 1981):

- o Minimize energy expenditures.
- o Make optimal use of renewable energy resources.
- o Plan for future energy flexibility.
- o Evaluate and incorporate conservation systems.
- o Use energy-efficient construction concepts and systems and technologies.

During planning and design, emphasis is being placed on energy conservation in the mechanical, electrical, and lighting systems. Operating bases will use centralized and computerized energy management and control systems. Insulation, reflective glazing, and thermal barriers could reduce heat gains and losses during the cooling and heating seasons.

A central cooling and heating facility (CCHF) is being considered in order to achieve greater energy system efficiency for all the buildings and residences on the operating base.

PASSIVE SOLAR DESIGN CONCEPTS (5.2.1)

As part of comprehensive planning, passive solar energy systems are being looked at for the operating bases and family housing.

Passive solar energy design makes use of the environment through proper siting of buildings, choice of building materials, and natural energy patterns to eliminate or minimize the use of conventional heating and cooling devices. Some typical passive features include correct building orientation, amount of southern glazing exposure, appropriate overhangs, inclusion of thermal mass for storage in either floors or walls, and venting and ducting which allows for the natural but controlled movement of air within the structure and with the outside environment. Passive systems, using readily available building materials, such as glass, stone, concrete, and masonry, and improved structural designs, may require little or no additional construction cost.

Passive solar design could save up to 70 percent of the heating loads, and 10-20 percent of the cooling loads, depending on the climatic conditions (National Solar Cooling and Heating Information Center).

ACTIVE SOLAR SYSTEMS (5.2.2)

An active solar system as a source of energy for the DDA and the operating bases is being looked at as an explained in detail in Sections 5.4 and 6.2.

Active solar systems on a smaller scale could also be employed to supply heating and hot water to onbase residential housing and in the communities.

Because of the intermittent availability of solar energy, some level of storage is desirable to help match the supply and demand profiles. The recommended solar contribution to space heating load is size and system specific. It ranges from 30 to 100 percent depending on climate, cost of alternative fuel, and unit storage cost.

Active solar systems could be used to supply about 50-60 percent of the domestic hot water load for new residential housing. These systems could be installed on individual homes. For offbase housing, this could add approximately an additional $800 to the cost of each home after federal tax incentives.

ENERGY CONSERVATION (5.2.3)

During the planning and design period, priority is being be placed on more energy conserving mechanical and lighting systems. Also the application of increased insulation will be enforced. This could reduce the heat gains and losses through the building of up to 50 percent for the heating season, and up to 20 percent during the cooling season, depending on the climatic conditions and amount of insulation.

Greater energy savings could be achieved by centralization of the heating and the cooling systems for all the buildings and residences on the bases.

Electric power consumption for lighting could be reduced by 30-35 percent through reduction of interior and facade lighting and also by use of more efficient

lights such as lower wattage incandescent or fluorescent lights (Craig B. Smith, 1976). This application could also reduce the cooling loads of the buildings. Other electric savings could be achieved by installation of high efficiency motors, appliances and load management devices. All these measures combined could save up to 15 percent of the total electric consumption of the bases and the new homes in the surrounding communities.

Installation of high efficiency hot water heaters (including heat pump water heaters), insulation of hot water tanks and pipes, and reducing the hot water set temperature to 120°F could reduce the energy consumption for domestic hot water by 10 percent.

Table 5.2.3-1 shows the comparison between energy consumption with the above-mentioned building construction and energy conservation methods for the bases and the communites for each alternative. Passive and active solar energy reductions were not included in these calculations. R-values for insulation were based on the minimum proposed federal rules and regulations for affected states.

5.3 MITIGATION MEASURES - ENERGY FACILITIES

MITIGATIONS FOR PIPELINES AND FUEL FACILITIES (5.3.1)

Energy transmission and production facilities installed or modified to serve the M-X system can be designed to mitigate potential impacts. In many cases, the selection of specific sites and rights-of-way can contribute the greatest effect toward the mitigation of impacts.

New natural gas or petroleum pipelines needed to supply fuel to M-X support facilities can be constructed either above ground or underground. A comparison of these techniques will be conducted and the technique having the least impact will be utilized. The design and selection of colors and materials for architectural screens, above-ground pipelines, and related facilities can be coordinated with landscaping to provide a pleasing appearance harmonious with its surroundings. The design configuration can minimize right-of-way requirements, thereby allowing a reduction in the clearing and removal of vegetation. The use of joint rights-of-way for roads, fuel, pipelines and electrical transmission lines could be utilized. Plowing in fiber optic cable to minimize surface disturbances is also a potential mitigation that may be utilized.

MITIGATIONS FOR ELECTRIC FACILITIES (5.3.2)

Energy transmission and production facilities that may be installed and/or modified as the M-X system is implemented can be designed to mitigate potential impacts. In many cases, the selection of specific sites and rights-of-way can contribute most toward the mitigation of impacts. Utilities may select transmission line structures designed for minimum right-of-way requirements, and substations may be of the low-profile type construction to maintain low structure height and to avoid the cluttered appearance of highbay lattice type design.

Table 5.2.3-1. Summary of 1992 annual energy consumption for DDA, operating bases, and support communities by alternative, with and without conservation measures, during operations phase.

Alternatives	Without Conservation				With Conservation			
	Fuel Oil 10^6 GA	Natural Gas 10^6 CF	Demand MW	Annual Use 10^3 MW	Fuel Oil 10^6 GA	Natural Gas 10^6 CF	Demand MW	Annual Use 10^3 MW
Proposed Action	9		234	1,115	5		203	1,038
1	9		234	1,113	5		203	1,036
2	9		230	1,095	5		200	1,023
3	12		235	1,126	8		204	1,048
4	9		234	1,115	7		204	1,038
5	12		241	1,129	8		204	1,051
6	9		235	1,119	7		203	1,041
7		1,105	242	1,161		791	208	1,069
8	4	509	250	1,169	3	359	218	1,084

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Note: Passive and active solar energy reductions are not included in this table.

Source: HDR Sciences.

In addition, the design and selection of colors and materials for substation fencing and transmission towers can be coordinated with landscaping to provide a pleasing appearance blended with the surroundings. Consideration can also be given to the aesthetic appearance of free-standing towers and structural supports for communications and control equipment. The configuration of conductors can be designed to minimize right-of-way requirements, allowing a possible reduction in the clearing and trimming of vegetative cover. Similar mitigative measures are possible for petroleum and natural gas facilities. Good right-of-way selection and aesthetic considerations could be emphasized in design and rights-of-way selection. Joint right-of-way use could be explored wherever possible.

5.4 MITIGATION MEASURES - ALTERNATIVE ENERGY SUPPLY SYSTEMS FOR M-X

The purpose of this section is to discuss the possible use of alternative energy technologies to supply specific electric load centers in the M-X system, or replacing conventional energy sources. In view of the many considerations and issues associated with the baseline energy option of utility supplied electric power, the Air Force is considering alternative ways of satisfying the electric (and thermal) energy needs of M-X ground facilities. One of these alternatives is a dedicated coal-fired power plant. If a cogeneration system is chosen, this alternative could relieve the necessity of drawing upon regional utility capacities, but would still have many potential impacts such as air quality deterioration, water consumption, wastewater generation, disposal of flue gas scrubbing sludge, and ash. Another alternative is the use of renewable energy systems (RES). The potential means of application of RES to M-X, and programmatic activities underway to develop these approaches, are discussed in the following paragraphs. Combinations of utility power, coal-fired plants, and RES approaches are also being considered by the Air Force.

The application of RES to M-X to satisfy either electric or thermal energy requirements must also satisfy energy availability requirements. For the DDA facilities (e.g., shelters, cluster maintenance facilities) and for the operating bases, the power system must ensure the provision of electric energy to at least a 0.999 availability fraction. Since it is impractical (except perhaps in the case of geothermal energy) to try to design a system solely dependent on renewable energy resources for these extremely high energy availability requirements, backup energy systems must be a part of any RES concept. Therefore, in the ensuing text, the term renewable energy system (RES) is used to connote the totality of a renewable energy conversion device plus energy storage, as well as on-site backup (e.g., diesel engines, ethanol turbines) and/or utility grid backup systems as necessary to satisfy the power and power availability requirements of a particular load.

THE M-X RENEWABLE ENERGY SYSTEMS PROJECT (5.4.1)

The Departments of Defense (DOD) and Energy(DOE) have initiated a major program to develop renewable energy systems (RES) for the M-X system complex. As a joint DOD/DOE effort, the M-X/RES Project reflects Air Force policy towards maximum practical use of renewale energy. M-X/RES Project activities are being conducted in accordance with a DOD/DOE Memorandum of Understanding (Appendix B). Initial technology assessments have been completed, program plans have been developed, and funding requests have been submitted to Congress. The accomplish

ment of project objectives through program execution is contingent upon Congressional funding approval.

The M-X/RES Project is structured into three major elements: (a) measurement of renewable energy resources in the M-X deployment area; (b) industry development of renewable energy system designs for M-X power requirements; and c) comparative evaluation of RES configurations, consisting of different combinations of renewable energy conversion, storage, and backup subsystems. Each system alternative will be developed to meet stringent M-X power and power availability requirements. Comparative evaluations will consider such factors as life-cycle cost, fossil energy use, required utility capacity, enhancement of M-X environmental compatability, technical and schedule risks, operating procedures and constraints, safety, electromagnetic pulse (EMP), preservation of location uncertainty (PLU), and contribution to national acceleration of RES applications.

At this early juncture, feasible RES applications to the M-X system complex have been conceptually defined. Initial findings show that RES offers significant environmental advantages over conventional energy system alternatives. Moreover, successful development of RES applications for M-X would accelerate national applications of renewable energy, and thereby support national goals for energy independence.

RENEWABLE ENERGY SYSTEMS FOR DDA FACILITIES (5.4.2)

There are two generic ways in which RES, designed to meet the needs of particular loads, could be applied to the designated deployment area (DDA): stand-alone shelter systems and cluster systems. These are discussed in the following subsection.

Stand-Alone Shelter Systems for Shelters and Other Facilities/Equipment

In this generic approach, individual RES could be used in a stand-alone mode (i.e., not connected to the utility grid) to power each M-X shelter. Similar stand-alone units, multiples thereof, or smaller units could be used to power other facilities in the DDA such as cluster maintenance facilities, communications devices and security devices. The remainder of this section will discuss both system and environmental considerations of the stand-alone shelter RES application.

The relatively small 12 to 23 Kw power output required for a single shelter could be supplied using solar thermal, photovoltaic, small wind systems, or combinations of these, deployed within each shelter's fenced-off area. These collection and conversion devices could be complemented with appropriate energy storage devices (thermal storage, batteries, etc.) and onsite backup systems. Stand-alone RES using solar thermal or photovoltaic technologies in combination with sufficient energy storage could provide approximately 75 percent of the annual energy needs of a shelter using renewable resources. If wind systems were combined with solar thermal or photovoltaic collectors, a much greater percentage of the annual energy needs of a shelter, perhaps as much as 95 percent, could be provided. The remainder of the energy would have to be provided by the onsite backups, since in this case there is no utility grid interconnect. The onsite backups would likely burn diesel power or ethanol, but these fuels would be burned in the remote regions

of the DDA. In the stand-alone shelter approach, no fuels would be burned at utility power plants which are typically located much closer to populated areas.

With a stand-alone shelter system approach, no transmission and distribution system for utility generated power would be necessary and hence the visual obtrusiveness of power lines and towers would be avoided. Water use associated with power generation for the totality of DDA facilities (approximately 70 Mw average) would also be minimized since the types of technologies cited do not require normal water cooling. If this power were to be utility generated, the water use would be approximately 3,500 acre ft annually, assuming a wet cooling tower system is used. No additional land would be required for these power systems since there is sufficient usable space within each shelter site for the necessary collectors.

Cluster Systems to Power Groups of Shelters

Power for DDA facilities could be supplied by larger RES designed to meet the requirements of a cluster (23 shelters at 0.35-0.5 megawatts each) or of multiple clusters (2 to 20 clusters at 1-7 megawatts each). A representative cluster group would contain 10 clusters, although the size of cluster groups could vary to accommodate varying numbers of clusters deployed in valleys of different sizes.

For the somewhat higher power levels associated with cluster RES, arrays of solar thermal dishes or troughs, or a solar thermal central receiver might be appropriate, as might be photovoltaic or wind systems. Here again, solar thermal or photovoltaic systems might be complemented with wind systems to try to provide a higher fraction of the annual energy requirement. Cluster wind systems could be located within the valley or cluster grouping, or could be located somewhat more remotely to take advantage of better wind resources (e.g., atop nearby ridges). Appropriate amounts of energy storage would also be required as would onsite backups.

Some land in each cluster grouping would be required for the cluster RES (approximately 50 acres for the representative 10-cluster grouping), though the amount of land which might otherwise be needed for increased utility generation capacity would be avoided. Depending on the particular RES technology utilized, complete avoidance of water use associated with electrical power generation might still be possible. However, if solar thermal central receiver technology was utilized the amount of water savings might be significantly less unless an air-cooled central receiver concept was feasible.

Cluster systems could be designed to operate in either a stand-alone or grid-connected mode. In the case of stand-alone cluster RES, the fractions of annual energy supplied from renewable resources would be sensibly the same as those indicated for stand-alone shelter RES in the preceding subsection. However, distribution lines would be required from the centralized cluster or cluster-group power units to the individual cluster, shelter and ancillary facilities, though these distribution lines, as in the utility power approach, would be underground. As in the stand-alone shelter case, no transmission lines for distributing utility power would be necessary, and the obtrusiveness of the lines and towers would be avoided.

In the case of grid-connected cluster systems, utility grid interconnect is used as the primary backup power source. Onsite backups (fewer in number than in the

case of stand-alone cluster systems) might still be required to ensure power availability fractions. However, in the grid connected cluster approach, the complete transmission system necessary for the utility power approach would have to be built, and there would be the concomitant visual impacts. Additionally, for that portion of the annual energy supplied by the backup utility systems, there would be fuel usage at the utility power plants as well as associated water usage.

While a grid-connected cluster RES requires transmission lines interconnecting with the utility grid, their presence would permit advantageous power transfers between the RES and the regional utilities. Since an insolation dependent RES generates its energy during the daytime, including the excess to be stored for overnight use, it could supply the excess energy (approximately four times the power level needed for instantaneous M-X use) to the utilities to satisfy daytime peak needs. The RES could receive this energy back from the utility at night to satisfy M-X needs. The overall effect would be to smooth the utility's generation profiles and facilitate a solution to peaking problems, as well as to lessen RES energy storage requirements and costs.

RES Deployment in the DDA

Deployment of shelter or cluster RES would best be concurrent with the construction of DDA facilities. As discussed earlier, M-X Renewable Energy System Project activities are oriented towards such a goal. However, if necessary, the renewable energy conversion devices could be phased in at a slightly later time and energy could be supplied by the RES backup devices (onsite and/or grid) in the interim. For stand-alone approaches, this would mean the burning of approximately four times more transportable fuel than would be used with RES installed, and for the grid connected approach a similarly higher amount of utility energy would be needed. Alternatively, construction of the transmission and distribution system necessary for the utility power approach could be performed for initial shelter and cluster deployments in the DDA, and these could be retrofitted with RES. This might be preferable to burning extra transportable fuels since the initial deployments in the DDA would probably be close to the operating bases and the utility grid, thus requiring only minimal expenditures for additional T&D facilities. Later stand-alone shelter and cluster deployments in more remote areas would not need the T&D facilities.

RENEWABLE ENERGY SYSTEMS FOR THE OPERATING BASES (5.4.3)

In applying RES concepts to satisfy operating base electric and thermal energy needs, it is likely that utility grid backup would be utilized as opposed to stand-alone RES approaches. This is because the OBs will be located close to civilian communities which are served by the utility grid; hence the need for supplementary T & D facilities at the operating bases would be minimal. Preferred RES concepts for OB applications are a strong function of the basic approach for satisfying OB thermal energy needs inherent in the operating base planning. OB thermal energy needs might be supplied from a central source, from distributed sources (i.e., on a district basis), or by electrically operated units within each OB building (an all electric approach). The use of renewable energy systems is compatible with any of the aforementioned thermal energy approaches, though the RES technologies and system concepts may vary. For example, if distribution of thermal energy from a central source was planned, then a solar thermal central receiver cogeneration plant

(where the electric output was backed up by the utility and the thermal output by a coal fired burner) might be an appropriate choice. If thermal energy supply on a district basis was planned, the same type of RES might be contemplated with the addition of distribution pipes to the district sources, or a combination of RES technologies could be used (e.g., solar thermal or photovoltaic technologies, alone or in combination with wind systems, could be used to satisfy electric energy needs, and solar thermal trough collectors located at the district heater sites could be used to offset fossil energy use for thermal energy). If an all-electric operating base were envisioned, solar thermal or photovoltaic RES, alone or in combination with wind systems, could be utilized.

For the operating bases, about 75 percent of the electric energy needs could be satisfied using renewable energy resources, and likely an even greater percentage of the thermal energy load. There would be a corresponding reduction in utility electric energy requirements and requirements for fossil-based central or distributed heating and cooling facilities, with associated reductions in water utilization, land utilization, and air pollutants. Some land would be required for these OB RES, the amount being a function of the electric and thermal requirements of the operating base, in turn a function of its size and location (which affects the thermal energy requirement for heating and cooling). Assuming a solar thermal central receiver cogeneration system for supplying the electric and thermal energy requirements of a main operating base located at Coyote Spring, Nevada (approximately 27 MW average electric power; approximately lc/100 billion BTU per month average thermal energy demand), about 475 acres of land would be required. The secondary operating base would require somewhat less than half that amount of land for a similar RES. As in the case of grid connected DDA systems, power transfer by the RES and the regional utility would be possible, and these might possibly be of greater benefit (for reasons previously discussed).

OTHER RENEWABLE ENERGY SYSTEMS APPLICATIONS (5.4.4)

In addition to RES concepts specifically tailored to the requirements of particular M-X loads (e.g., shelters, clusters, operating bases), other RES options are also being considered. Among these are (1) large scale wind systems which could take advantage of wind resources identified in resource assessment activities; (2) geothermal systems for electric and/or thermal energy configured to take advantage of geothermal resources in or near the deployment areas; (3) the use of transportable fuels derived from biomass materials (perhaps using geothermal or solar energy for their processing) for powering stand-alone systems, onsite backups, or possibly vehicles used in association with M-X operations. Geothermal or large-scale wind systems likely would feed their energy into the utility grid, and hence could supply a portion of OB electric power needs. They could also supply electricity to the DDA if grid-connected DDA power approaches were implemented (or if resource sites were within the DDA and the RES could directly feed selected stand-alone valleys or cluster groupings).

PRELIMINARY M-X ENERGY SYSTEM COST COMPARISONS (5.4.5)

The achievement of environmental benefits associated with the RES option could be on a competitive basis with the utility power option. The competitive life-cycle costs for the RES options are attributable to several factors. For an RES

configuration incorporating stand-alone powering of the M-X shelters, higher energy generation equipment costs would be more than offset by the elimination of an extensive power transmission and distribution system, and certain voltage reduction and ac-to-dc conversion equipments in each of the 4,600 shelters. (Stand-alone power of the shelters could provide significant additional benefits to the M-X system by reducing its vulnerability to EMP effects and faciliting PLU.) Additionally, there would be fuel cost savings, though not proportional to the reduction in fossil energy use (75 percent) since costs of energy from onsite backup generators would be higher than that from utilities. For a configuration in which M-X shelters are powered by more centralized cluster RES, life-cycle costs would be somewhat higher since parts or all of the transmission and distribution system would be needed, as would the power conversion equipment within the shelters. Costs would still be competitive with the utility power option, as fuel cost savings generally offset increased equipment and maintenance costs. Additionally, a grid-connected cluster RES configuration would exhibit the least sensitivity to differing fuel costs scenarios.

6.0 RENEWABLE ENERGY SYSTEMS

6.1 GENERAL DISCUSSION

This section describes alternative energy resources and systems and their potential to augment conventional energy resources. It summarizes ETR-265, "M-X Systems Environmental Program, Analysis of Alternative Energy Systems" (HDR Sciences, March 1980). The RES described below are illustrative of those to be assessed by the M-X/RES Project.

Related documents and sources of information include the following:

1. U.S. Department of Energy, Office of Procurement Operations. "M-X Renewable Energy Systems (M-X/RES) Information Package," September 1980, with addenda I through IV.

2. Fugro National, Inc., "Alternative Energy Sources for the M-X System Nevada/Utah," 25 February 1980.

TECHNOLOGIES CONSIDERED (6.1.1)

This report considers alternative energy systems which could be technically feasible for utilization in the M-X program. These include solar thermal, solar electric, wind, energy storage, geothermal, wood, alcohol fuels, and solid waste.

These technologies are alternatives to conventional systems, such as fossil fuel, nuclear, and hydroelectric; they have a near-term potential for commercialization, as distinct from magnetohydrodynamics, and nuclear fusion. In addition, they do not include synthetic fuel development for oil shale which is fossil-based and nonrenewable.

ANTICIPATED ENERGY REQUIREMENTS (6.1.2)

Refer to Section 2 of this ETR for anticipated energy requirements.

REDUNDANCY AND REPLACEMENT (6.1.3)

Alternative energy systems would mitigate M-X energy impacts by replacing conventional generating capacity and fossil fuels that would otherwise be needed. They could also be used to improve reliability by providing one more degree of redundancy to the system as shown below:

Sources of M-X Electrical Energy

Base and Intermediate Loads

1. Multiple connections to the utility grid.
2. Alternative energy systems.

Peaking and Emergency Loads

1. Standby generators in the power distribution centers.
2. Batteries in the M-X ROSE equipment compartment.
3. Alternative energy storage systems.

AVAILABILITY vs. CAPACITY FACTORS (6.1.4)

Availability is defined as the ratio of the time power of acceptable quality is provided to the time it is required, which in the case of M-X, is continuous. The power availability requirement at the interface of each technical facility. Thus, unavailable time is limited to no more than 8.76 hours per year.

Each energy technology can be categorized by means of its capacity factor (ratio of its annual energy actually produced compared to its nameplate capacity if operated for 8,760 hours - number of hours in a year). Technologies are described in Table 6.1.4-1.

This categorization is a good indication of the applicability of each technology, as summarized in Table 6.1.4-2.

None of the alternative energy systems have a capacity factor which would permit 0.999 availability without multiple units and considerable storage or backup conventional systems.

DISCUSSION CRITERIA (6.1.5)

In the remaining sections of this appendix the following aspects of each alternative energy technology are briefly discussed:

1. Technical overview
2. Demonstration and commercialization status
3. Siting considerations
4. System description
5. Environmental concerns

The final section discusses which technologies would be applicable to which electric load centers in the M-X system.

Additional discussion and sketches of the alternative energy concepts may be found in ETR-265, "Analysis of Alternative Energy Systems," (HDR Sciences, March 1980).

6.2 SOLAR ENERGY SYSTEMS

The sun is the source of many forms of energy, including hydroelectic power, biomass, wind energy, waves, thermal currents, and thermal density gradients. Fossil fuels contain stored solar energy. In the context of this report, however, there are two basic concepts for solar energy systems: thermal and photovoltaic.

TECHNICAL OVERVIEW (6.2.1)

Solar thermal systems include flat plate collectors, parabolic trough and dish, and the central receiver or power tower concept. Their collection capabilities and primary applications are as shown in Table 6.2.1-1.

Table 6.1.4-1. Capacity Factors.

	Hours Per Year	Capacity Factor
Base	More than 5,000	More than 0.60
Intermediate	3,500 to 5,000	0.40 to 0.60
Peaking	Less than 1,500	Less than 0.20

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Table 6.1.4-2. Applicable technologies.

Technology and Capacity Factor	Probable Supply Function
Solar	
Central Collector (0.35 to 0.75[1])	Intermediate to base
Parabolic Dish and Trough (0.35 to 0.75[1])	Intermediate to base
Photovoltaic (0.35 to 0.75[1])	Intermediate to base
Wind	
Horizontal Axis Turbine (0.35 to 0.60[1])	Intermediate
Vertical Axis Turbine (0.35 to (0.60[1])	Intermediate
Combination Wind and Solar (0.6[1] to 0.95[1])	Base
Geothermal (0.75)	Base
Biomass	
Wood Pelletization (0.75)	Base
Methanol from Wood (0.20)	Peaking
Ethanol from Agricultural Crops (0.20)	Peaking
Ethanol for Mobile Fuels	Mobile
Solid Waste	Base
Energy Storage	
Underground Pumped Storage	Peaking
Compressed Air in Caverns	Peaking
Batteries	Intermediate-Peaking
Thermal Storage	Intermediate
Fuel Cell	Intermediate-Peaking

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[1]Indicates: with storage.

Source: ETR-265, pg. ES-2.

Table 6.2.1-1. Solar Thermol System Collection Capabilities and Primary Applications.

Collector	Temperature Range	Primary Application
Flat Plat	Low to Medium 50° C to 150° C	Space Heating
Parabolic Trough or Dish	Medium to High 200° C to 800° C	Process heat and electricity
Heliostats and Central Receiver	High 200° C to $1,100^{\circ}$ C	Process heat and electricity

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Photovoltaic cells convert sunlight directly into electricity through the use of semiconductor materials.

DEMONSTRATION FACILITIES (6.2.2)

Tables 6.2.2-1 (A-D) lists numerous solar thermal demonstration and related test facilities being planned, constructed, or operating throughout the United States and other countries.

SITING CONSIDERATIONS (6.2.3)

The southwestern United States, in which the alternative M-X deployment regions are located, is one of the best geographic areas in the country for high incident solar radiation and annual coverage total hours of sunshine. Table 6.2.3-1 shows the total hemispheric daily solar radiation average over a full year based on multiyear data from the SOLMET Program, maintained by the National Weather Service (NWS). In this region, solar radiation generally increases as follows:

1. From east to west due to prevailing winds and the influence of mountains on weather patterns and cloud cover.

2. From north to south due to decreasing latitude.

3. With increasing elevation because atmospheric losses are less at higher altitudes.

Possible sites for solar power plants should contain sufficient level land with no shadowing from surrounding topographical features. Generally, shadows should not be present when the sun is 10° or higher above the horizon at any time of the year.

Concept studies performed in the M-X/RES Project using existing solar insolation data have shown that RES systems can provide at least 75 percent of the M-X energy requirements. It also appears quite likely, using existing wind data for the M-X study regions, that with the addition of Wind Energy Conversion Systems, RES can provide up to 95 percent of the M-X energy requirements.

The M-X/RES Project has initiated a comprehensive insolation and wind resource measurement program for the prospective deployment areas to augment available data provided by the National Weather Service (insolation), Sandia Laboratories (wind), Battelle Pacific Northwest Laboratories (wind), and National Climatic Center (wind). The insolation data from the NWS is adequate to define regional insolation values but site specific data will also be required. Since wind requirements are quite site specific, measurement data for pre-selected locations will be required prior to final site selection and Wind Energy Conversion System (WECS) design. The results of this resource evaluation program will be utilized in the final site selection and in the design of the solar power systems for the M-X system.

SYSTEM DESCRIPTION (6.2.4)

Solar Thermal Flat Plate Collectors (6.2.4.1)

Table 6.2.2-1A. Solar thermal test facilities (Page 1 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
General Atomic Co. San Diego	Concentrating Fixed Mirrors	$51 m^2$	--	Test Loop for demonstrating molten salts as a heat transfer fluid (1100^oF)	1979
Sandia Labs, Albuquerque; Mid-temperature Solar System Test Facility (MSSTF)	Distributed Dishes and Line Focus Concentrators	$1000 m^2$	Various	Testing of developmental collectors, receivers for total energy uses (750^oF)	1978
Sandia Labs, Albuquerque; Central Receiver Test Facility (CRTF)	Heliostat Field and Tower with interchangeable receivers (222 heliostats)	$8880 m^2$	$5 MW_t$	Testing of developmental and prototype receivers ($2.4 MW_t/m^2$ @ 3900^oF)	1978
Advanced Components Test Facility (ACTF) Atlanta, GA	Heliostat Field and Tower	$522 m^2$	$400 kW_t$	R&D in high temperature solar technology (Solar Furnace)	1977
JPL/Edwards AFB Parabolic Dish Test Site (PDTS)	Parabolic Dishes 6m, 11m	$1100 m^2$	$85 kW_t$ Typical	Test bed for concentractors, receivers, power conversion and thermal transport systems	1979
U.S. Army, White Sands, NM	Spherical Mirror ($67 M^2$) illuminated by a heliostat ($132 M^2$)	$132 m^2$	$35 kW_t$	Solar Furnace @ 4760^oF	1958
U.S. Army, White Sands, NM	Paraboloid	$490 m^2$	$350 kW_t$	Solar Furnace @ 4940^oF	1981

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Table 6.2.2-1A. Solar thermal test facilities (Page 2 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
Odeillo, France	Parabolic Mirror ($2400m^2$) illuminated by 63 heliostats ($2830m^2$)	$2830m^2$	$1MW_t$	Solar Furnace @ 6900^oF	1970
NSAS/Langley	Flat Plate	$1300m^2$	$900\ kW_t$	Supplies heating and cooling to 54,000 ft^2 building	--
NASA/Marshall	Flat Plate	$400m^2$	--	Testing of commercially manufactured collectors and heating, cooling systems	--

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Sources: "Focus," newsletter of the Solar Thermal Test Facility Users Association (STTF-VA), Albuquerque, NM, various newsletters (1981); "Solar Thermal Report," JPL (newsletter), various issues.

Table 6.2.2-1B. Solar thermal demonstration systems (Page 1 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
Willard, NM, New Mexico State Univ. and Sandia	Distributed Trough	$625 m^2$	50hp	Irrigation Pumping System Powered by Organic Rankine Cycle turbine (325°F)	1977
Coolidge, AZ	Distributed Trough	$2,141 m^2$	$150 Kw_e$ (22 MWhe/mo)	Irrigation Pumping System, delivering seasonal electric power to utility (550°F)	Jan 80
Johnson & Johnson Plant, Sherman, TX	Distributed Trough	$1,070 m^2$	125×10^6 Btu/mo.	Process Steam @ 1600 lb/hr.	May 80
Shenandoah, GA	Distributed Dish (7m dia.)	$7,380 m^2$	$400 kW_e$	Congeneration System for Industrial Knitwear Plant (650°F)	1982
Almeria, Spain (International Energy Agency)	Distributed Trough	$2,700 m^2$	$500 kW_e$	Electric Generating Plant	Jun 81
Nio Town, Japan	Central Receiver	$12,900 m^2$	$1 MW_w$	Electric Generating Plant	May 81
Barstow, CA (So. Cal. Edison)	Central Receiver (1818 heliostats)	$71,770 m^2$	$10 MW_e$	Electric Generating Plant	Jun 82
Sacramento, CA Campbell Soup Co.	Parabolic Trough & Flat Plate	$682 m^2$	--	Can Washing Line (195°F)	Nov 77

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Table 6.2.2-1B. Solar thermal demonstration systems (Page 2 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
Harrisburg, PA York Bldg. Products	Multiple Reflector Line focus	$857 m^2$	--	Concrete Block Curing (135°F)	Sep 78
Coca Cola Bottling Works, Jackson, TN	Flat Plate	$880 m^2$	900×10^6 Btu/mo.	Space and hot water heating	Sep 79
Redding, CA Cosmetics Plant	Flat Plate	$627 m^2$	--	Boiler Feedwater Preheat (200°F)	Jul 80
Fresno, CA Commercial Laundry	Flat Plate	$625 m^2$	--	Hot Water (160°F)	Sep 77
Decatur, AL	Flat Plate	$1218 m^2$	--	Preheat to Soybean Drier @ 180°F	May 78
Fresno, CA	Flat Plate	$1952 m^2$	--	Fruit Drying @ 143°F	Aug 78
Gilroy, CA	Evac. Tube (Flat Plate)	$550 m^2$	--	Boiler Feedwater Preheat; Onion Drying @ 194°F	Sep 79
Canton, MS	Flat Plate w/Reflectors	$234 m^2$	--	Kiln Drying of Lumber @ 180°F	Nov 77
Fairfax, AL	Parabolic Trough	$700 m^2$	--	Industrial Fabric Mfg. Plant (Dryers) @ 320°F	Sep 78
Bradenton, FL	Evac. Tube	$930 m^2$	--	Frozen Food Thawing @ 300°F	Dec 80

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Sources: "Solar Thermal Report," JPL, various issues; "Parabolic Dish Project Newsletter," JPL, various issues; "Solar Age," Solar, Inc., Harrisville, NH, various issues; "Solar Engineering Magazine," Solar Engineering Publishers, Inc., Dallas, TX, various issues.

Location	Type	Receiver Total Aperture	Power Level	Status
Albuquerque, NM Central Receiver Test Facility (CRTF)	Water/Steam Receiver (70 tube panel for Barstow Pilot Plant)	$10m^2$ (panel)	1-2 MW_t	Successfully tested in 1980, in Static and Dynamic Modes (1100°F)
"	Molten Salts Receiver (800 tubes, $20.3m^2$ in a cavity)	$9m^2$	$5MW_t$	497 hours of solar testing successfully completed 3/81 (1050°F)
"	Liquid Sodium Receiver (Three 21-tube Panels)	$5m^2$	$2.5MW_t$	Tests to begin 8/81
"	Brayton Cycle (Air-cooled Cavity Type)	--	$1MW_t$ @ 1500°F	Fabrication Started 7/80
Crosbyton, Texas	Linear Focus Prototype for $5MW_e$ System (Hemispherical Bowl)	$1m^2$	10 kW_e	Initial Operation 1/80; Electrical Prower Prod-duced 3/81 (1000°F)
JPL Parabolic Dish Test Site (PDTS) Edwards AFB	Steam Rankine Receiver (Ceramic)	$1m^2$	85 kW_t	Test completed 6/81 (1600°F-2600°F)
"	Air Brayton Cycle Receiver (Cavity Type)	$1m^2$	200 kW_t	Tests in 1981
"	Organic Rankine Receiver & Power Converter	$1m^2$	200 kW_t	Scheduled for Test 9/81
Albuquerque, NM Central Receiver Test Facility (CRTF)	Commercial Scale Molten Salt Receivers for stand-alone and Repowering Applications (2 Designs).	--	320 MW_t	Design and Fabrication Development in '81, '82; and Testing at CRTF in '82, '83. Program Complet 2/84

T5189/9-13-81/F

Sources: "Solar Thermal Report," JPL, various issues; "Parabolic Dish Project Newsletter," JPL, various issues; "Solar Age," Solar, Inc., Harrisville, NH, various issues; "Solar Engineering Magazine," Solar Engineering Publishers, Inc., Dallas, TX, various issues.

Table 6.2.2-1D. Photovoltaic array demonstration systems (Page 1 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
Schuchuli Indian Village (NASA LeRC)	Flat Photovoltaic Array	--	3.5 kW_e	Village power	Jan 1979
Upper Volta Village (NASA LeRC)	Flat Photovoltaic Array	--	1.8 kW_e	Village Power	Jul 1979
Remote (NASA LeRC)	Flat Photovoltaic Array	--	2.5 kW_e	Remote Stand-alone	1978
Natural Bridges, UT	Flat Photovoltaic Array	--	100 kW_e	National Park Lighting	Jul 1980
Mead, Nebraska	Flat Photovoltaic Array	--	28 kW_e	Irrigation; Crop Drying, Fertilizer Production	Jan 1978
Bryan, Ohio	Flat Photovoltaic Array	--	15 kW_e	Radio Station Power	Jul 1979
Mt. Laguna, CA	Flat Photovoltaic Array	--	60 kW_e	Radar Facility	Jan 1979
Kauai, Hawaii	Parabolic Trough	892m^2	60 kW_e	Electrical and Hot Water Load of Hospital	--
Arizona Public Service, Phoenix, Arizona	Circular Fresnel	2088m^2	225 kW_e	Airport Terminal	--
Albuquerque, NM (BDM)	Parabolic Trough, Roof-mounted	625m^2	47 kW_e	Electricity and Space Heating for Office Bldg.	--

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Table 6.2.2-1D. Photovoltaic array demonstration systems (Page 2 of 2).

Location	Type	Total Aperture	Power Level	Application	Initial Operating Date
Dallas, TX	Linear Fresnel Roof-mounted	$245m^2$	28 kW_e	Airport Utility Plant Lighting and Feedwater Preheat	--
Lovington, NM	Photovoltaic Flat Array	$2255m^2$	150 kW_e	Power to Shopping Center	--
El Paso, TX	Photovoltaic Flat Array	$263m^2$	17.5 kW_e	Uninterruptible Power Supply	--
Oklahoma City, OK	Photovoltaic Flat Array with Reflectors	--	150 kW_e	Power to Cultural and Science Building	--
Beverly, Mass	Photovoltaic Flat Array	$2177m^2$	1000 kW_e	Power to 280,000 ft^2 High School Building; surplus sold to utility	Apr 1981

T5190/9-13-81/F

Source: "Summary of Systems Designs for Photovoltaic Experiments and Recommendations for Future Activities, Sandia, SAND80-7069.

Table 6.2.3-1. Total hemispheric mean daily solar radiation.

Location	Annual Average, kj/sq m
Ely, Nevada	19,000
Roswell, New Mexico	20,000
El Paso, Texas	19,000
Cedar City, Utah	19,800

T5191/10-2-81/a

Source: "Input Data for Solar Systems" NOAA, (August 1979) Interagency Agreement No. E(49-26)-1041.

The flat plate collector is the most common type of solar energy collector, and is commercially available in various configurations from many manufacturers. The classic flat plate collector consists of a black metal absorber enclosed in an insulated box with a glass or plastic cover. Various materials and coatings, piping configurations, etc., enhance the collector's efficiency. Collected heat is transferred to a "working" fluid, such as air or water, and piped to its end-use, or to storage to await its end-use.

Flat plate collectors are generally fixed into position to optimally collect solar radiation on an annual basis. Their efficiency varies with climatic changes. When water is used as a working fluid in application sites where ambient temperatures go below freezing, an anti-freeze compound is added to the receiver coolant and a heat exchanger is used to transfer the collected heat to the end-use water. An advantage that flat plate collectors have over concentrating types is that they can effectively collect diffuse radiant energy, hence are quite effective on days with hazy sunshine when the concentrating type is less effective.

Flat plate collectors are used primarily for low temperature applications, and have found wide use in residential space conditioning, domestic hot water heating and commercial uses of hot water. It is envisioned that they could be utilized for meeting a portion of the heating and cooling demands of the M-X Operating Bases.

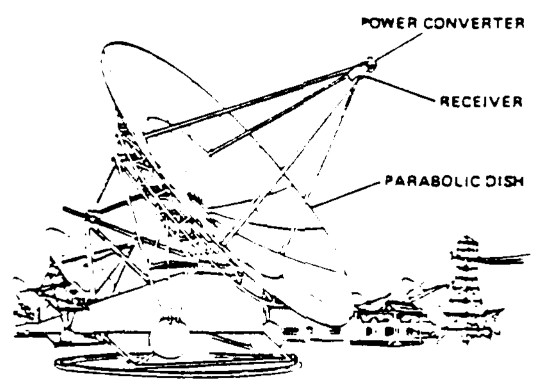
Solar Thermal Parabolic Trough and Dish (6.2.4.2)

The parabolic dish module is capable either of generating electricity, and/or supplying heat, depending on the type of receiver used. A representative dish configuration is shown in Figure 6.2.4.2-1.

For electric applications the module consists of three subsystems: the concentrator, the receiver, and the power conversion unit. An automatic control system enables each module to track the sun across the sky. The concentrator collects solar energy from a large area and focuses it to a very small area. The receiver, which is mounted at the focal point, captures the concentrated radiation, and converts the energy to heat in a working fluid, such as hot gas. The working fluid transports the energy to the heat engine of the power conversion unit, which is mechanically linked to the electric generator. In the simplest configuration of the system, the power conversion unit is located atop the receiver, at the focus. Storage of solar energy for operation when sunlight is not available, is effected by means of a battery system. The optical portion of the concentrator is a parabolic reflector, although lens concentrators are also being considered.

To produce thermal energy, the power conversion unit is replaced with an appropriate receiver having flexible lines to conduct the working fluid to a heat transfer network on the ground. This configuration supplies heat to a centralized electric generating unit or for process head or both. Storage of this hot fluid makes it possible to operate the plant when no sunlight is available.

The principal advantage of dish solar collectors are (1) the high temperatures attainable, (2) the inherent modularity of dish collectors, (3) the ease of collecting the power output of each dish in electrical form, and (4) the high percentage of the



SOURCE 'Solar Thermal Power Systems Parabolic Dish Project,' Annual Technical Report, fiscal year 1980, DOE/JPL - 1060-45, May 15, 1981

4834-A

Figure 6.2.4.2-1. Dish concentrator.

available solar insolation which is collected. The high temperatures available from dish systems results from their inherently high concentration ratio. These temperatures result in high power conversion efficiencies.

The DOE has a program to demonstrate the technical, operational, and economic readiness of dish technology for electric and thermal power applications. To reach this goal in a timely manner, the project has three parallel elements:

1. Technology development - develop first generation equipment.

2. Advance development - development of equipment for second generation.

3. Applications development - market applications of each system.

Testing of dish hardware is well underway. Dish units have been developed to operate with receiver fluid temperatures up to 750°F have been tested and are now being installed for use in a total energy application at Shenandoah, Georgia.

An additional experiments has been defined, and is known as the "Small Community Solar Thermal Power Experiment." It is one megawatt in size and looks toward the grid-connected market of the continental United States. The collector will be first-generation gechnology as developed by the project.

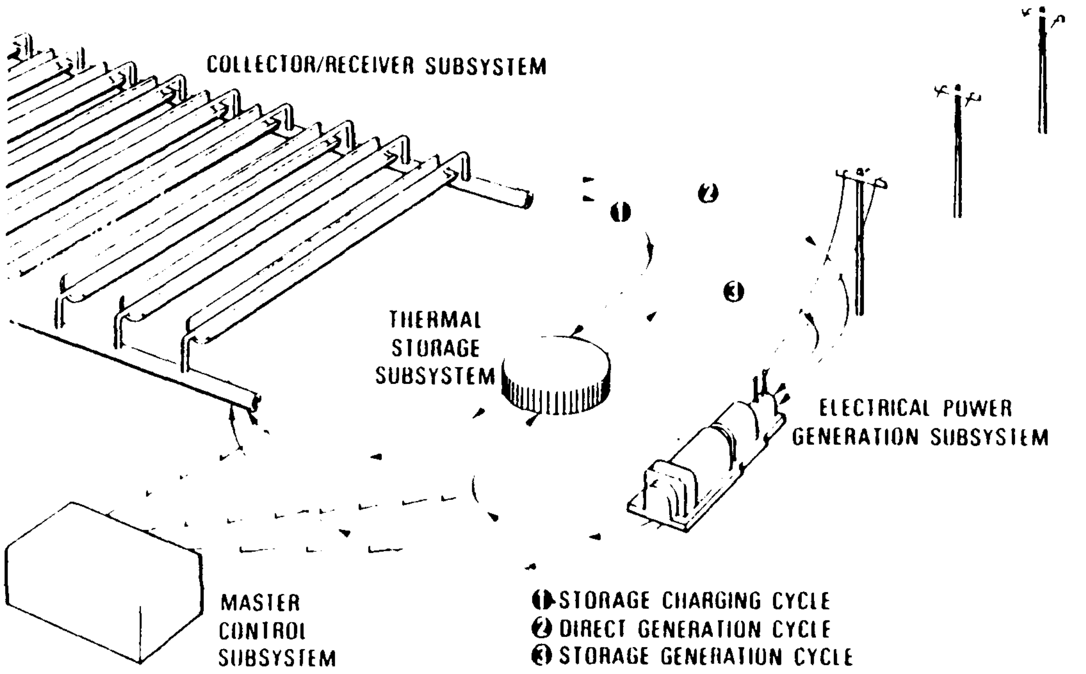
Solar Thermal Parabolic Trough

The parabolic trough is capable of producing electrical and/or thermal energy. It consists of a linear receiver located above a cylindrical parabolic shaped concentrator which rotates about an axis parallel to the receiver axis (see Figure 6.2.4.2-2). The axis can be oriented east-west, north-south, or polar (parallel to the earth's axis). The parabolic trough can provide concentration ratios in the range of 30 to 60. The resulting collector temperatures range from 300 to 700°F. A working fluid is circulated to collect and transport the solar heat from the collectors to a central storage tank as an energy supply when no sunlight is available as well as for normal operations.

The warm fluid in storage is pumped to the power conversion unit (organic-Rankine or lower pressure water steam-Rankine working fluid) on demand. The unit would be centralized and colocated with the heat rejection system (dry or wet cooling towers). Process steam an be produced from storage (500 to 600°F) or from turbine extraction points (450°F).

The principal advantages of parabolic trough systems are (1) modular design, (2) operational simplicity, and (3) high reliability. These advantages result from lower equipment operating temperatures, and minimum number of components in the field and use of identical modular components.

The parabolic trough technology is rapidly approaching commercial viability. DOE has programs to improve trough efficiency and reduce hardware costs. DOE is also developing integrated system designs which stress reliability along with improved system performance and which can be installed with a minimum of site specific engineering and construction costs. Four contractors have been selected by



SOURCE: 'Line Focus Solar Central Power Systems,' USDOE RFP ET-78-R-03-2073, July 5, 1978 4833-A

Figure 6.2.4.2-2. Parabolic trough distributed receiver concept.

DOE to develop designs to provide improved thermal performance, greater durability and reliability, and increased potential for mass producibility of trough system and components. The goal of these programs is to provide systems of proven 65 to 75 percent collection efficiency (this translates into systems efficiencies of 14 to 17 percent) and costs of $15/sq ft by 1983. Lifetime goals are from 10 to 30 years.

Solar Thermal Central Receiver Solar Plant (6.2.4.3)

A schematic of a central receiver system is shown in Figure 6.2.4.3-1. A field of individually controlled mirrors, or heliostats, reflects the sun's energy onto a receiver mounted on a tower. At the receiver, highly concentrated solar flux heats a circulating fluid which is used to power a conventional steam or gas turbine. This same hot fluid may also be stored for later use thus making it possible to operate the plant when no sunlight is available. The achievement of economic storage is a significant advantage which increases the flexibility of operation and allows greater energy displacement. The operating hours of a solar central receiver plant can also be extended by the addition of a nonsolar energy source such as fossil fuel or hydro.

The major advantages of the central receiver concept are (1) use of conventional power conversion equipment, (2) high operating temperatures produce high conversion efficiency, (3) expected low cost, and (4) use of waste heat thereby effecting operation as a cogeneration facility.

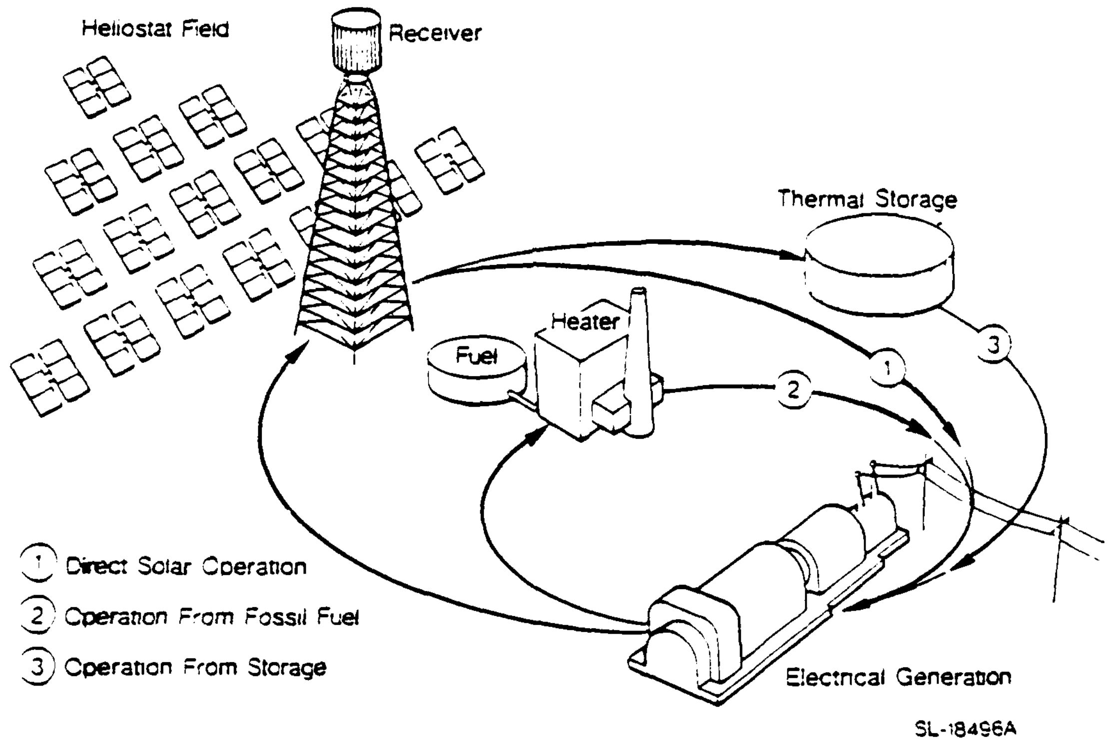
Depending on the design, the overall conversion efficiency (percentage of incident sunlight converted to electrical energy) is in the range of 15 to 18 percent. Cost goals are in the range of 1,500 to 2,000 $/kwe.

The U.S. Department of Energy is conducting a long term Solar Central Receiver Program where objectives are to develop central receiver component and system technology and to conduct system demonstrations as an initial step of commercialization. Program elements include technology development of components (receivers, heliostats, and storage) and construction of demonstration projects.

Major projects are listed in Paragraph 2.2. The Central Receiver Test Facility (CRTF) has now been fully operational since 1978. The CRTF has tested prototype heliostats. The facility has 222 38-m^2 mirrors and a 61-meter tower on which receiver experiments are mounted.

A pilot plant is being built at Barstow, California, and will have 1,818 40-m^2 mirrors, a tower approximately 70 meters tall, and will deliver 10 Mw of electricity to commercial grid network. Operation is expected in late 1981. The Southern California Edison Company, a commercial utility, will operate the plant in conjunction with the Los Angeles Department of Water and Power.

The International Energy Agency (IEA) is building a 0.5-Mwe plant in Almeria, Spain. The United States is partially funding the plant along with Germany, Switzerland, Spain, Belgium, Sweden, Greece, Austria, and Italy. The plant will begin operation in mid-1981 using personnel from Sevilliana, a Spanish utility.



SOURCE: K.W. Battleson, 'Solar Power Tower Design: Solar Thermal Central Receiver Power System,' Sandia National Laboratories, SAND -81-8005, April, 1981

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Figure 6.2.4.3-1. Central Receiver System.

Photovoltiac Array (6.2.4.4)

The basic subsystems of a photovoltaic power plant are the solar cell array, elect ical interconnections, power conditioner/control, and energy storage witn auxil ary backup power as required to meet system availability requirements. The diffe-ent types of photovoltaic arrays are pictured in Figure 6.2.4.4-1.

The heart of any photovoltaic power system is the solar cell. It is the transducer that converts the sun's light energy directly into electricity, and is basically a semiconductor diode. The maximum theoretical efficiency for the conversion of sunlight to electricity via the photovoltaic effect is around 25 percent; however, practical conversion efficiencies presently attainable are between 10 - 15 percent depending principally on the materials used. For sunlight conditions in the Southwestern United States, where the maximum insolation intensity is close to 1 kW/m^2, electrical output in the range of 100-150- w/m^2 is possible.

The connection of solar cells in series and parallel and incorporation into a module provides a unit which can be interconnected with similar modules to comprise an array. In principle, array sizes at the multimegawatt level are possible, being limited mainly by land availability considerations.

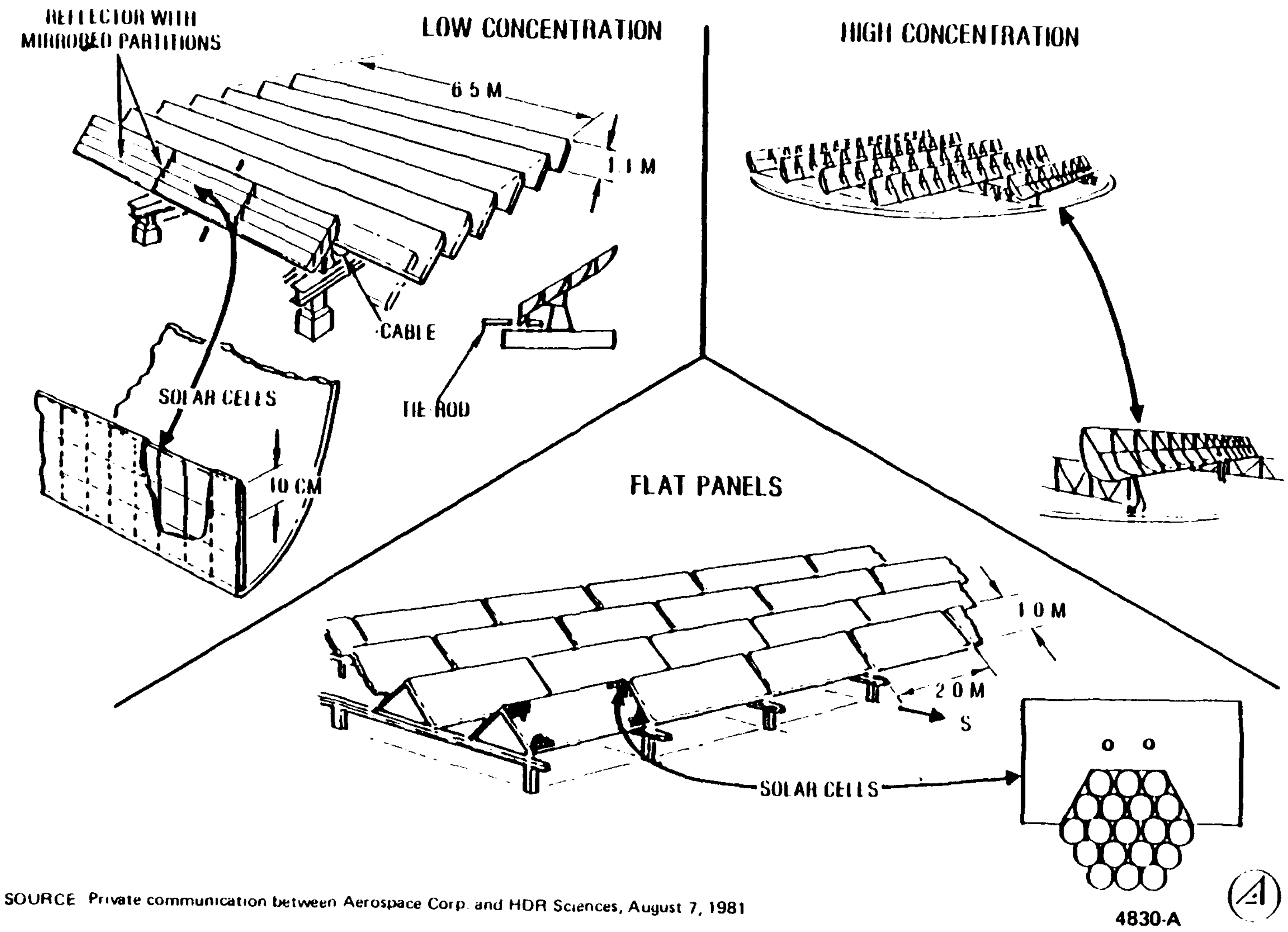
The federal government, through the Department of Energy (DOE), has established a multiyear National Photovoltaic Program. The objective of this program is to reduce systems costs to a competitive level in both distributed and centralized grid-connected applications. Equally important, the program is designed to resolve the technical, institutional, legal, environmental, and social issues involved in fostering widespread adoption of photovoltaic energy systems. It is the plan of the program to achieve advanced materials technology development and automated production no later than 1988. At that time it is expected that large costs reductions will be realized so that solar photovoltaics can achieve specific collector costs of $0.70/Wpeak, or a plant cost of about 2.0/Wp. The ultimate goal of the program is to attain a specific cost of $0.15 - 0.40/Wp for collectors in central station applications.

The suitability of using solar photovoltaics for the M-X program is based on a technological maturity dating back more than 20 years. Solar photovoltaics have been the primary power source for the large majority of U.S. satellites placed in earth orbit. Their reliability in providing continuous power to the satellites is well proven and this technology has been transferred to terrestrial applications. It can be expected that solar photovoltaics will provide durable, reliable and environmentally clean power.

ENVIRONMENTAL CONCERNS (6.2.5)

The most important siting concern for power production efficiency is siting where solar insolation is optimal and where transmission losses can be minimized. The M-X region provides an ideal situation for solar power due to excellent solar resources; the use of RES may eliminate the need for a large percentage of the planned transmission lines.

A summary of the major beneficial and adverse effects of M-X/RES systems is listed below:



SOURCE Private communication between Aerospace Corp. and HDR Sciences, August 7, 1981

Figure 6.2.4.4-1. Solar Array Configurations, Description of Technology-Photovoltaics.

- The M-X/RES contribution to the long-range nondefense applications of RES generation could be extremely beneficial to society and the national environment.

- Some pumping of groundwater for cleaning and plant cooling may be required.

- Some centralized RES concepts may displace land containing semiproductive vegetation and wildlife.

- Noise, conventional safety hazards, security requirements and boiler or heat storage failure could present minor problems during construction and operation.

- A power tower might present obstacles to aircraft.

- Plant's visiblity will moderately alter the area's aesthetic value.

- Air quality impacts for plant construction and operation will be negligible.

RES plant siting may be restricted by land and water constraints. Solar systems should avoid nearby mining or industrial activities whose airborne emissions may cover or corrode collector surfaces.

Solar systems are designed to withstand the following environmental phenomena:

1. Low levels of earthquake activity in the deployment region.

2. Damage from wind loads and from debris carried by wind (collectors can be turned face down when wind speeds exceed certain limits).

3. Flooding, hail, and excessive snow loads.

The solar plant's relatively minor, short-term environmental effects are offset by the benefits in relation to regional planning considerations.

The degree of RES generation utilized will eliminate a proportional amount of regional coal mining, coal or oil induced air quality degradation, water usage and waste disposal. Solar thermal development will probably induce less net growth than similar capacity fossil plants due to the solar systems independence from fuel mining, transportation and distribution, and its reduced manpower, air pollution control and other appurtenant requirements. On the debit side the RES plants will initially probably require (per unit of electricity produced) more mineral extraction (steel, cement, etc.) for their material-intensive development.

6.3 WIND ENERGY SYSTEMS

TECHNICAL OVERVIEW (6.3.1)

Wind energy has been used for centuries for pumping water, grinding grain, propelling ships, etc. In recent years, however, technology has been applied to develop large wind turbines capable of generating electricity in the megawatt

ranges. Wind energy could supply several percent of the total U.S. supply by the turn of the century.

There are basically two configurations of wind turbines: horizontal axis and vertical axis. Horizontal axis turbines are reminiscent in appearance to windmills, while vertical axis turbines have two or three fixed-pitch curved blades which have both ends attached to a rotating vertical shaft.

The most important point in wind power is adequate and sustained wind velocity. Power input is a function of wind velocity cubed. To increase the average wind speed blowing past a turbine from 10 mph to 15 mph results in a power output increase of 238 percent.

Average wind speeds of 15 to 18 mph and greater, which are desirable for turbines, are more likely to be found in the mountains, ridges, and passes in the M-X deployment regions. Wind speeds on valley floors usually average less than 10 mph.

DEMONSTRATION FACILITIES (6.3.2)

The Wind Energy Systems Act of 1980 (WES) initiated an eight-year, $900 million program to develop cost-effective wind power systems in the United States. The National Science Foundation has invested $30 million in wind research during the last four years, $1 million of which has financed initial construction on the 100 kw Experimental Wind-Turbine Generator near Sandusky, Ohio. The U.S. Department of Energy (DOE) and the National Aeronautics and Space Administration have spent over $6 million to construct the world's largest windmill in Boone, North Carolina.

Table 6.3.2-1 lists horizontal axis turbines that are part of a wind energy demonstration program by the U.S. Department of Energy and NASA.

The Schachle turbine has a three-blade rotor that turns at a variable speed depending on wind velocity, rather than the two-blade constant speed of the DOE/NASA concept. By "riding-the-wind," the machine can maintain an optimum blade top speed to wind speed ratio and maximize its efficiency through a wide range of wind velocities. Demonstration facilities for the Schachle turbine are listed in Table 6.3.2-2.

SITING CONSIDERATIONS (6.3.3)

In the M-X study region nearly all wind speed data is obtained at weather stations that are located at local airports in wide valleys where average wind speeds are not sufficient to justify wind energy systems. Yelland Field at Ely, Nevada, has one of the highest average wind speeds (10.5 mph) for airports in the region. Average wind speeds of 15 to 18 mph and greater, which are desirable for siting wind energy conversion systems, are more likely to be found in the mountains, ridges, and passes. At the Ely Tracking Site on Kimberley Mountain the average wind speed is reported to be 20 to 25 mph.

Although there are many mountains in the study region, other siting problems such as access, isolation, rime ice, excessive winds, etc., would militate against siting wind generators in such exposed locations. Preferable sites include mountain passes, ridges, and other changes of topography which cause increases in wind speed due to the Bernoulli effect (converging of streamlines), especially those which are

Table 6.3.2-1. Horizontal axis turbine demonstration facilities.

Type	Rotor Diameter (ft)	Capacity (kWe)	Wind Strength (mph)	Location	Year of Startup
MOD-O	125	100	18	Sandusky (Plum-brook Station), OH	1975
MOD-OA	125	200	18	Clayton, NM	1978
MOD-OA	125	200	18	Culebra, PR	1978
MOD-OA	125	200	18	Block Island, RI	1979
MOD-OA	125	200	18	Oahu, HA	1980
MOD-1	200	2,000	26	Boone, NC	1979
MOD-2	300	2,500	20	Goldendale, WA (3 machines)	1980-81
Advanced	200	*	Low	*	1982
Advanced	125	*	Low	*	1983

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*To be determined.

Source: ETR-265, pg. 3-4.

Table 6.3.2-2. Schacle turbine demonstration facilities.

Location	Rating	Size	Status
Moses Lake, WA	--	72' diameter	Operating since 1972
San Gorgonio Pass, CA So. California Edison	3 Mwe	165' diameter	Startup mid-1980 for testing in system

Vertical axis turbine demonstration facilities.

Location	Rating	Status
Magdalen Islands, Gulf of St. Lawrence	200 kWe	Operating since 1977
Sandia Laboratories Albuquerque, N. Mex.	50-60 kWe	Operating
Eugene, OR	500 kWe	Planned
San Gorgonio Pass, CA So. California Edison	500 kWe	Planned

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perpendicular to the direction of the prevailing wind. In the siting region, elevations below 7,000 to 8,000 feet may be required to avoid rime ice accumulations which could cause structural damage to wind turbines blades and electrical transmission lines.

Preliminary siting of wind turbines can be achieved by surveying ecological indicators such as wind-induced deformities of trees or other foliage.

Other considerations requiring siting or design precautions include:

1. Wind turbulence due to weather or terrain
2. Wind shear due to large changes in wind speed or direction over the diameter of the rotor
3. Extreme winds
4. Thunderstorms and lightning
5. Icing
6. Heavy snow loads
7. Moisture infiltration
8. Freeze-thaw cycles
9. Blowing dust

SYSTEM DECRIPTION (6.3.4)

Both horizontal and vertical axis turbins are being considered.

Horizontal Axis Turbine (6.3.4.1)

The main components of a horizontal axis wind turbine include rotors, transmission system, generator and electrical subsystem, controls, and tower. The rotor is the largest production cost element of a wind turbine and practically the only component not available "off-the-shelf".

Key design criteria requirements for a rotor are:

1. Maximum aerodynamic efficiency

2. Structural integrity to withstand high winds, icing, bird strikes, temperature extremes, and lightning

3. Long operating life

4. Conducive to mass production technologies

Technology associated with wind turbine rotors is somewhat similar to that already developed for propeller rotors and helicopter blades. Propeller-type rotors offer a stiffer structure in the flapwise and torsional direction. Smaller blade deflections reduce clearances required between the rotor and the tower support. For a maximum weight-strength combination, a probable blade assembly would be a fiberglass filament-wound exterior with an aluminum interior shell or honeycomb.

The transmission system must transfer the low-revolution, speed high torque of the rotor (typically 20 to 40 rpm) to a high-speed, low-torque (about 1,800 rpm) generator shaft. A fixed-ratio gear system tied to a fixed 1,800 rpm generator (to

synchronize with the utility grid) means that the rotors must be variable pitch to maintain constant rotor speed in a variable wind speed pattern. To mimimize transmission length and complexity, the generator is normally placed atop the tower at the hub of the rotor. The Schachle turbine's generator is placed on the ground, however, and a hydraulic transmission, rather than mechanical, links it with the rotor.

The control system helps to maximize power output from variable wind speed and direction.

Vertical Axis Turbine (6.3.4.2)

A vertical axis turbine has the following advantages over a horizontal turbine:

1. Accepts wind from all directions requiring no direction control

2. All working parts (generator, transmission, controls, etc.) are at ground level. No tower is required and there are no weight or bulk limitations

The primary disadvantage of a vertical axis turbine is that it is not self-starting.

ENVIRONMENTAL CONCERNS (6.3.5)

Wind energy has few environmental concerns. The primary ones are:

1. Visual: The maximum tower plus rotor heights can be approximately 300 feet (90 meters). Since they will likely be placed on hilltops and ridges, they will be visible for long distances.

2. Ecological: Rotating blades could cause threats to birds, insects, etc. At 35 rpm, the tips of a 200-foot diameter rotor would be moving at 250 mph.

3. Electromagnetic waves: Wind turbines with metal rotors cause interference with local radio, TV, and radar.

4. Noise and vibration: The rotation of large diameter windmill blades can cause low frequency noise and vibration which can have detrimental effects on the human and animal population.

In the M-X application, wind systems, particularly larger ones, would probably be in remote, generally unpopulated locations. Care would be exercised to avoid their placement near known bird migratory routes. Thus, the aforementioned environmental concerns can be alleviated.

6.4 ENERGY STORAGE

TECHNICAL OVERVIEW (6.4.1)

When contemplating the use of solar and wind energy systems, the need for energy storage becomes more critical due to the diurnal and seasonal variations of

solar insolation and the capricious nature of the wind. Several concepts for large scale energy storage are at various stages of availability. Concepts which seem to have potential for implementation in the M-X program include the following:

1. Pumped hydro
2. Compressed air storage
3. Batteries
4. Thermal storage
5. Fuel cells

The characteristics of some of these systems are summarized in Table 6.4.1-1.

PUMPED HYDRO (6.4.2)

Pumped hydro is currently the only well established energy storage technology that is available on an electric utility grid scale. Currently in the United States, there is approximately 10,000 Mw of installed pumped storage capacity in addition to about 59,000 Mw of hydroelectric capacity. Pumped storage facilities include those at Taum Sauk, Arkansas; Ludington, Michigan; and Niagra Falls, New York. Additional projects have been proposed for northern California.

The concept of pumped storage is simple. Inexpensive base-loaded power is used to store energy during off-peak hours by pumping water from a lower reservoir to an upper reservoir. During peak hours, the water flows from the upper reservoir through a hydroelectic turbine down to the lower reservoir.

The use of conventional pumped hydro in the M-X region does not seem likely due to the scarcity of water and large evaporative losses which would occur from surface reservoirs. However, underground pumped hydro storage is being investigated by several utilities. Underground excavations or natural caverns could be considerably smaller than surface reservoirs because the elevation difference could be several thousand feet compared to a typical surface pumped-storage system which is generally less than 1,000 ft. Energy-storage capacity is directly proportional to the elevation differential.

The primary environmental concerns of underground pumped storage would be the negative impacts of construction activity and disposal of excavated material. A minor problem may be the disruption of underground aquifers.

Although an underground pumped hydro system is technically possible for implementation in the M-X program, it is highly unlikely that one would ever be built due primarily to the minimum required capacity. It appears that economic viability would require a minimum generation capacity of 200 Mw, which is larger than the 180 Mw connected load for M-X technical facilities and considerably larger than any peak loads for which this type of energy storage is intended.

COMPRESSED AIR STORAGE (6.4.3)

Considering M-X needs and the geologic characteristics of the region, an underground compressed air storage system seems more appropriate than pumped hydro. In this type of system, air is compressed during off-peak hours and stored in large underground reservoirs which could be natural caverns, salt domes, abandoned

Table 6.4.1-1. Expected technical and cost characteristic of storage systems applicable to M-X renewable energy systems.

	Lead Acid Batteries	Thermal Sensible Heat	Hydro-Pumped Storage	Compressed Air
Commercial availability	Present	Before 1986	Present	Present
Economic plant size (MWe-hr)	20-50	500	200-2000 MW	200-2000 MW
Storage-related cost (dollars per kwh)	200	5-10	5-20	10-30
Power-related cost (dollars per kw)	150	50-100	150-250	200-300
Expected life (years)	5	30	30	20-30
Efficiency (percent)	60-70	90-99	70-75	40-50
Construction lead time (years)	2-3	3-5	8-12	3-12

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Source: Personal communication between Aerospace Corp. and HDR Sciences, August 7, 1981.

mine shafts, depleted gas and oil fields, or other types of man-made caverns. During peak hours the air is released through a turbine-generator.

This method has several advantages over pumped hydro: a wider choice of geological formations, higher energy density for compressed air than stored water, and a smaller minimum size for economic attractiveness.

The world's only compressed air storage facility is located near Bremen, West Germany. During off-peak hours, air is compressed to 1,000 psi and stored in two caverns leached out of a salt dome. During peak demand, the air is released, heated by natural gas, and expanded through high and low pressure turbines which can generate 290 Mw for about 2 hrs. Companies investigating compressed air storage in the U.S. include the Potomac Electric Power Company in Maryland, the Electric Power Reserach Institute in Kansas, and Public Service of Indiana.

To supply a peaking capability for the M-X system of 20 to 40 Mw for 6 hours would require a storage volume of 2 to 4 million cubic feet at 600 to 800 psi. Possible geotechnically suitable sites in the M-X region for underground storage of compressed air include the following:

1. Natural solution caves in carbonate rocks
2. Abandoned mine shafts and tunnels
3. Salt domes in the Las Vegas area
4. Natural gas and oil-bearing strata
5. Confined aquifers
6. Caverns created by underground nuclear explosions

Containment of high pressures may be difficult in certain formations because of fractures and interconnected solution cavities. Underground nuclear explosions, such as at the Nevada Test Site, do not produce large net volumes of open space, and extensive radioactive cleanup would be required.

BATTERIES (6.4.4)

Batteries are advantageous for energy storage since their input and output is entirely electrical and their response to changes in electric load is quick and efficient. They are particularly adapted to wind turbine and photovoltaic solar systems, to modular construction, and to dispersed use in the distribution system.

Lead-acid battery modules should be suitable in the capacity range of 20 to 50 Mw, which would match M-X program requirements. Other types of batteries using various metals and chemicals for electrodes and electrolytes have promise for higher energy density storage capabilities and lower costs than lead-acid batteries. Some of the combinations include nickel-iron and nickel-zinc, zinc-chlorine, sodium-sulfur, and others. First commerical availability of these batteries is in the early to mid-1980s. Redox energy storage systems are also being considered. Battery characteristics are shown in Table 6.4.4-1.

The primary environmental concern is human exposure to the chemicals and gases produced during the charging and discharging cycles.

Table 6.4.4-1. Battery characteristics summary table.

Characteristics	Units	Lead-Acid	Nickel-Cadmium	Nickel-Iron	Zinc-Chloride	Zinc-Bromide	Sodium-Sulfur	Lithium-Sulfur
Electrochemical Couple		$Pb/H_2SO_4/PbO_2$	Ni/Cd	Ni/Fe	Zn/Cl_2	Zn/Br	Na/6	LiFe S
Nominal Operating Voltage	Volts/Cell	1.95	1.25	1.2	1.95	1.6	1.7	1.2 - 1.3
Nominal Operating Temperature	^oF	Ambient	Ambient	Ambient	Ambient	125	570-660	750-930
Nominal Energy Efficiency	Percent	75-85	75-85	65-70	71-75	70-80	70-75	75
Throughput Energy Efficiency	Percent	60-65	60-70	60-65	65-70	70-75	60-70	70
Self Discharge Rate	Percent Mo.	1-10	5	40	0	0	0	10
Nominal Cycle Life at 80%					2500[2]	2000-5000[2]	2500-5000[2]	3000[2]
Depth of Discharge	Cycles	500-1000	500-2000	500-2000				
Nominal Calendar Life	Years	5-10	24	7-12	10	10	TBD	TBD
Energy Specific Weight	Lb/w-iR	53-250	71-83	27	36	110	45,	21-28
Energy Specific Volume	Ft^3/kWh	0.44-1.93	0.53-0.83	.4	.49	2	.14	.1-128
Initial Battery Cost	$/kW-HR	100-150	400-600	TBD	TBD	TBD	TBD	TBD

◄-- Existing (Lead-Acid to Nickel-Cadmium) --► ◄-- Under Development (Nickel-Iron to Lithium-Sulfur) --►

◄-- Ambient Temperature (Units to Zinc-Chloride) --► ◄-- High Temperature (Zinc-Bromide to Lithium-Sulfur) --►

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[1] These figures should be regarded only as guidelines, since they differ with battery design and duty. Some are projections from cell performance only.

[2] Development target.

Source: Private communication between Aerospace Corp. and HDR Sciences, 7 August 1981.

THERMAL STORAGE (6.4.5)

A thermal storage system has the greatest application with a thermal solar central receiver or a parabolic dish or trough collector system. Thermal storage systems involve the use of well insulated chambers filled with heat-retaining materials, such as rock, oil, eutectic (low melting point) salts, water, cast iron, and other materials. High temperature and pressure steam or other working fluids from the solar collectors or power towers are directed to the storage chamber during the solar day. When the sun is down or clouded over, thermal heat can be recovered from the storage chamber and fed directly to the electric generating equipment.

The primary environmental concerns of thermal storage relate to potential leaks of heated working fluids which leach salts into surrounding aquifers and accidental discharge of toxic materials, which may be part of the working fluid.

FUEL CELL (6.4.6)

A fuel cell has the capability of acting as an energy storage-conversion system and being used as a peaking (load-following) device in the M-X system. A fuel cell system includes a fuel processor, a power section, and a power conditioner. The fuel processor converts a utility fuel such as naphtha, natural gas, methanol, or ethanol to a hydrogen-rich gas by steam reforming. The power section, consisting of a phosphoric acid electrolyte sandwiched between two electrodes, combines the hydrogen-rich gas and oxygen to produce water and electric power. Waste heat can be used for the fuel processor and/or other uses. The power conditioner converts d.c. electrical output to a.c., which is compatible with a standard utility grid.

A fuel cell has a higher conversion efficiency than conventional thermal generators, and its efficiency is not size dependent. Modular units can be quickly added to a fuel cell plant as demand increases.

The relatively small 12 to 23 kW power output required for a single shelter could be supplied using a fuel cell plant at each individual shelter. With the single shelter system approach, no transmission and distribution system for utility-generated power would be necessary and hence the visual obtrusiveness of power lines and towers would be avoided. However, additional traffic would occur due to delivery of fuel to tanks buried outside the shelter.

A 4.5 Mw demonstration fuel cell plant, sponsored by DOE, EPRI and Con.Ed. of New York, is being built in Manhattan. Delays have been experienced due to pressure testing and other measures to meet stringent local fire code requirements for flammable materials.

A fuel cell plant has few environmental concerns. It is quiet and has few emissions other than carbon dioxide, air, and water. Sulfur and other emissions could result from the fuel processor if petroleum or coal-derived fuels are used.

6.5 GEOTHERMAL ENERGY SYSTEMS

TECHNICAL OVERVIEW (6.5.1)

Recovery and utilization of heat trapped within the earth's crust is the primary object of geothermal energy development. Depending on the quantity and quality of geothermal resources tapped by drilling, geothermally heated fluids may

be used for electrical generation or in a variety of direct applications, such as space heating and cooling or industrial process use. Figure 6.5.1-1 shows the geothermal resources in Nevada/Utah region.

RESOURCE TYPES (6.5.2)

Geothermal resources of near-term interest are of three types, hydrothermal, geopressured, and hot dry rock.

Hydrothermal Systems (6.5.2.1)

Hydrothermal systems are convective systems of water and steam that are trapped in fractured rocks or permeable sediments by impermeable surface layers. Geothermal fluids may be released when such systems are tapped by drilling. A specific resource is classified as being either vapor- or liquid-dominated, according to the state of the fluid produced.

Hydrothermal resources have high potential for near-term commercial development. For example, vapor-dominated resources are presently being used for the generation of electricity in the United States, Japan, and Italy; liquid-dominated resources are in use in Ireland, Mexico, El Salvador, Russia, and New Zealand.

Geopressured Systems (6.5.2.2)

Geopressurized zones consist of highly porous sands saturated with saline water at very high pressure and temperature. The high temperature is thought to be the result of normal heat flow being trapped by uncompacted clays which serve as insulating layers. Waters derived from the compaction and dehydration of clays accumulate in the sands and greatly increase the fluid reserve. The marine sediments are under-compacted below depths of 6,500 to 10,000 ft, and the interstitial fluid carries part of the overburden load (i.e., the fluids are at pressures between the hydrostatic and the lithostatic head). Temperatures up to 290°C and pressures up to 1,000 atmospheres have been measured in these systems. In the United States, the principal geopressured formations are locatd under the gulf coast of Texas and Louisiana. The magnitude of the resource is substantial, and its economic value is enhanced by the presence of natural gas dissolved in the geopressured fluid; however, difficult technical and economic problems must be solved before geopressured resources can be utilized commercially.

Hot Dry Rock Systems (6.5.2.3)

Hot dry rock resources are those geothermal reservoirs where the heat is contained in rock of low permeability. Hot dry rock systems are potentially the largest and most widely distributed geothermal resource in the nation. A large volume of hot dry rock (normal gradient resource) is located in the earth's crust at depths in excess of 15 km (50,000 ft), which is beyond present drilling capability. However, the volume of hot dry rock at temperatures greater than 2,983°C at depths less than 5 km (16,000 ft). Two specific promising areas are the Valles Caldera, near Los Alamos, New Mexico, and the Coco Hot Springs, near China Lake, California. Other potential sites being evaluated are located on the eastern coastal plain, the midwestern region, and the Pacific Coast.

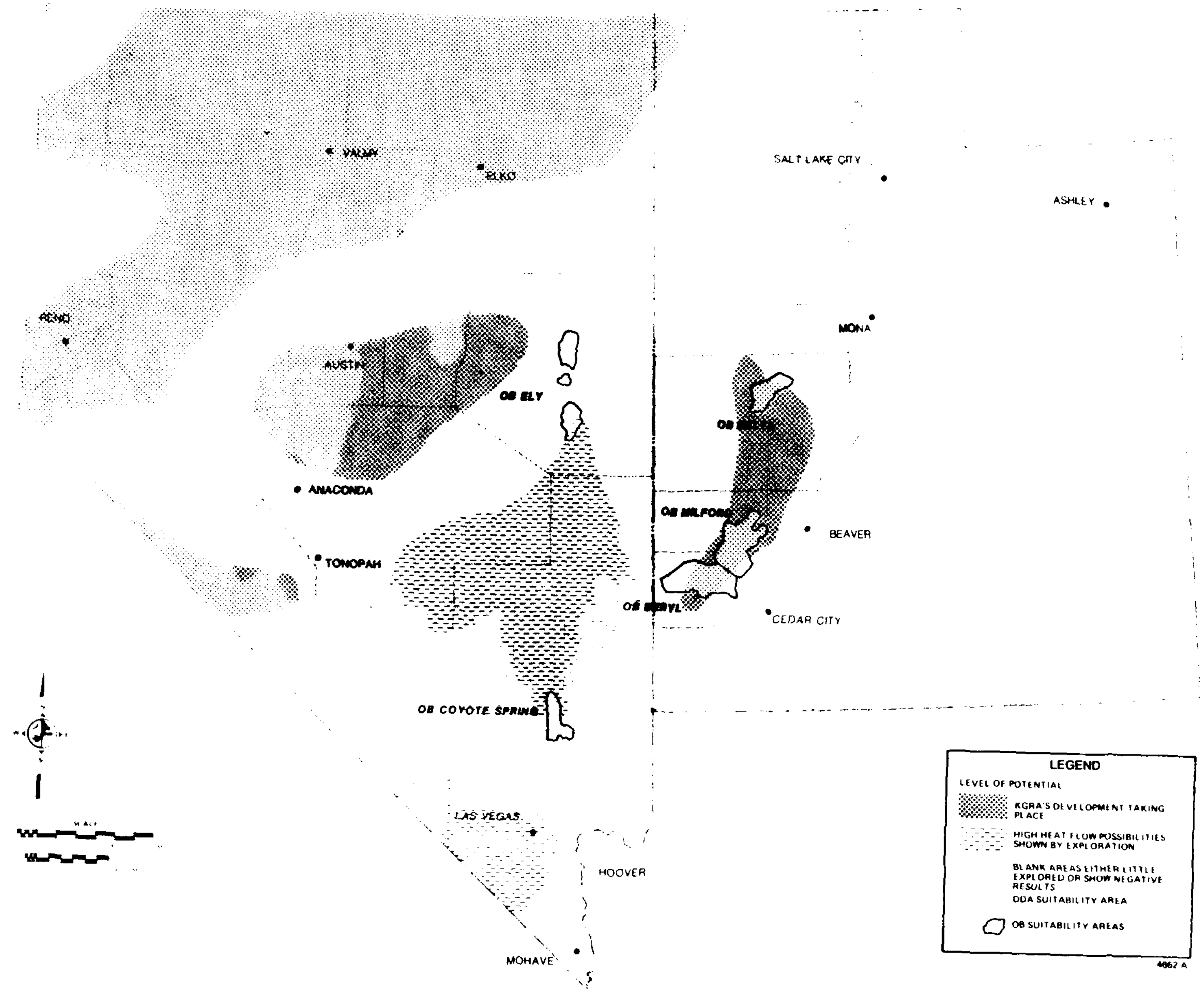

Figure 6.5.1-1. Geothermal resources in Nevada/Utah region.

Development of these resources requires drilling into the rock, inducing fractures, injecting fluid, and removing the resultant heated fluid through separate wells. Technical problems associated with fracturing and maintainig the fractures must be solved before these resources can be developed commercially.

ENERGY CONVERSION AND UTILIZATION (6.5.3)

Thermal reservoirs or "hot spots" concentrate heat energy in local geologic formations. The ultimate use of these resources depends on whether they are of the hydrothermal, geopressured, or hot dry rock type.

The state of technology for utilization and conversion of geothermal energy is different for vapor-dominated and liquid-dominated resources. The steam turbine industry is considered to be in an advanced state of development. equipment in use throughout the world is producing commercial quantities of electricity from vapor-dominated geothermal sources using technology adapted directly from the fossil-fuel power industry. Furthermore, if the hydrothermal fluid is above 200°C, its well head pressure can be reduced so that part of the water vaporized (flashes) into steam. Conversion efficiency is about 15 percent, and, most important, conventional steam turbine technology may be used to produce electricity.

About half of the electricity-grade hydrothermal energy in the United States is in this high-temperature range (200°C and above). The other half is in the moderate-temperature range (130°C to 200°C), for which the direct-flash technology may not be economically feasible.

Energy conversion and utilization processes depend strongly on the nature of the geothermal fluid, principally on whether it is vapor-dominated or liquid--dominated. An important consideration is that certain geopressured fluids contain methane that can be extracted for use, in addition to the heat and pressure energy. The fluid characteristics for hot dry rock resources fall within the range of those for hydrothermal and geopressurized resources, so that the same energy conversion processes are applicable. When geothermal fluids are used for space heating, no turbogenator is required, so the process is considerably simplified while the the environmental imapcts are not significantly different. the description of conversion processes will focus on the use of hydrothermal and geopressurized resources for generation of electricity. Although hot dry rock resources are widely distributed geographically, their current development is in the early research stage.

OPERATING AND DEMONSTRATION FACILITIES (6.5.4)

See Table 6.5.4-1 for a list of U.S. Geothermal projects.

GEOTHERMAL RESOURCES IN THE M-X REGION (6.5.5)

The Basin and Range Province is characterized by high regional heat flows induced by tectonic activity. The insulating effect of thick sedimentary layers in many valley areas increases the already high thermal gradient. Extensive fault systems provide conduits for deep water circulation. In addition, young volcanic activity in several areas has creasted local hot spots.

Table 6.5.4-1. Representative U.S. geothermal projects. Operating and demonstration facilities.

Location	Purpose	Technology	Capacity (MW)	Starting Date	Sponsors
The Geysers, California	Electricity commercial	Natural steam cycle	800	1960-1980	Pacific Gas and Electric Co., Union Oil Co., of California
Heber, California	Electricity, demonstration	Binary cycle	45	1964	DOE; EPRI; San Diego Gas & Electric Co; Chevron Resources Co.
East Mesa, California	Electricity, pilot	Binary cycle	11	1979	San Diego Gas and Electric Co.; Magma Power Co.
Raft River, Idaho	Electricity experiment	Binary cycle	5	1980	DOE
Baca Location, New Mexico	Electricity demonstration	Direct-flash steam cycle	50	1982	DOE; Public Service Co. of New Mexico Union Geothermal Co. of New Mexico
Northern Nevada (site to be selected)	Electricity, commercial	Direct-flash steam cycle	50	1984	Sierra Pacific Power Co. and other utilities; Phillips Petroleum Co.
Heber, California	Electricity, commercial	Direct-flash steam cycle	41	1982	Southern California Edison Co.; Chevron Resources Co.
Roosevelt Hot Springs, Utah	Electricity, commercial	Direct-flash steam cycle	20	(Pending)	Utah Power & Light Co.; Phillips Petroleum Co.
Brawley, California	Electricity, pilot	Direct-flash steam cycle	10	1980	Southern California Edison Co.; Union Oil Co. of California
Boise, Idaho	District heat, commercial	N/A	N/A	1981	DOE: State of Idaho; City of Boise
Crisfield, Maryland	Hydrothermal, exploration	N/A	N/A	1979 (Reached 60°C water)	DOE
Brazoria County, Texas	Geopressure, exploration	N/A	N/A	1979 (Well complete)	DOE
Valles Caldera, N.M.	N/A	Binary cycle	$50MW_e$	1983	
Fenton Hill, N.M.	Developing, fracturing, and circulation technology	Hot Dry Rock	N/A	N/A	Los Alamos Scientific Laboratory
Niland, California	Geothermal loop experimental facility	Binary cycle	$10MW_e$	N/A	N/A

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Note: N/A Not available

Source: HDR Sciences, 1981.

The only known vapor dominated systems in the United States occur at the Geysers, at Lassen Volcanic National Park in northern California, and at Yellowstone National Park in Wyoming. Within the M-X region, it is anticipated that liquid dominated convective hydrothermal resources would be most prevalent. For example, numerous liquid dominated hydrothermal systems have been identified across northern Nevada. Additional systems occur at Roosevelt Hot Springs and Sulphurdale near Milford, in southwestern Utah, at Valles Caldera in northern New Mexico in the Lightning Dock area of southwestern New Mexico.

The M-X/RES Project Office has initiated a comprehensive geothermal resource measurement program for the prospective deployment areas to augment available data provided by Circular 790 (U.S.G.S.) FUGRO National, Inc., EPRI, and TRW. These data, and in particular, the data from Circular 790 are adequate to define regional geothermal values but site specific data will be required. Since geothermal data requirements are extremely site specific, measurement data for pre-selected locations will be required prior to final site selection. The results of this resource evaluation program will be utilized in the final site selection and in the design of any geothermal power systems for the M-X system.

SYSTEM DESCRIPTION (6.5.6)

Geothermal resources with temperatures less than about 300°F are considered marginal prospects for electrical generation based on current technology. Lower temperature reserves are best suited for direct application in space heating and cooling or industrial process use.

There are two basic energy conversion concepts suitable for electrical energy production from liquid dominated, hydrothermal resources: direct flash and binary fluid plants.

In a direct flash system, heated geothermal liquid is extracted from wells, introduced into a single or multiple flash chamber(s) and "flashed" to steam. Flashed steam is expanded through a turbine generator to produce electricity.

In a binary cycle system, geothermal liquid or flashed steam is run through a heat exchanger to release its heat and vaporize a secondary organic fluid such as isobutane, isopentane, or propane. The secondary fluid vapor is expanded through a turbine generator to produce electricity. The secondary fluid vapor is exhausted from the turbine, condensed, and pumped back to the heat exchanger for recirculation. The geothermal liquid is pumped back into the ground to recharge the hydrothermal reservoir.

Geothermally heated fluids can also be used in a hybrid concept with fossil fuels to heat boiler feedwater and/or combustion air so that fossil fuels are burned more efficiently in a power plant.

Design requirements for a geothermal plant are unique in certain aspects. The combination of high dissolved solids plus high temperatures can create a very harsh environment, which causes erosion, corrosion, and sediment buildup in piping and equipment. Binary plants must be well protected against leaks of highly flammable organic liquids or vapors at high temperatures and pressures.

ENVIRONMENTAL AND INSTITUTIONAL CONCERNS (6.5.7)

Environmental concerns with geothermal energy development include the following:

1. Air: primary air emissions are noncondensable gases associated with geothermal fluids such as hydrogen sulfide, carbon dioxide, methane, and ammonia. Control methods include burners, scrubbers, and reinjection.

2. Water: geothermal brine spills could be a source of thermal and water pollution. Electrical generating plants require water for cooling, unless less efficient dry-air systems are used.

3. Land subsidence: removal of geothermal fluids without reinjection can result in sinking of the land surface. Reinjection is recommended.

4. Noise from steam operations. Enclosure baffles are used.

Institutional constraints with geothermal development include the following:

1. Lack of clear environmental guidelines which tends to delay approvals required from regulatory agencies.

2. Uncertainty as to the legal classification of geothermal resources as minerals or water, and applicable usage rights. Water rights have traditionally been associated with potable sources. At issue is whether landowners, who routinely possess title to surface water, also have the rights to geothermal resources on their property.

3. Existing and proposed leases for geothermal resource areas.

4. Patents and trade secrets involved in new technologies.

6.6 BIOMASS

TECHNICAL OVERVIEW (6.6.1)

Within the M-X region, biomass does not occur in significant quantitities that are renewable on a long-term basis, except for solid waste in scattered communities and agricultural crops in the High Plains Region. However, sufficient biomass materials may exist in states surrounding the region.

The most likely biomass sources include:

1. Ethanol derived by fermentation of agricultural crops
2. Solid waste energy recovery
3. Wood wastes densified into pellets
4. Methanol derived by thermochemical decomposition of wood wastes

ETHANOL (6.6.2)

Ethanol is produced by the fermentation of agricultural foodstock. It can be used to generate electricity in fuel cells or conventional gas turbines. It can also be used as a mobile fuel in internal combustion engines (gasohol, dieselhol, or straight ethanol).

Sufficient foodstock exists in numerous counties in California, Idaho, Arizona, and the Great Plains region to supply millions of gallons per year of ethanol from wheat, corn, grain, sorghum, barley, rye, and potatoes.

The primary by-products from an ethanol plant are protein rich syrups and distillers dried grain which have a high market value as feed supplements. Carbon dioxide is another byproduct which can be used to produce dry ice or fire extinguisher charges, or to decrease spoilage in feedstock storage.

SOLID WASTE (6.6.3)

Solid waste is a by-product of human consumption and its quantity is directly related to population and density.

Considerable solid waste resources exist in urban areas within the M-X region. Since landfill costs are generally low, additional economic incentives would probably be necessary to stimulate community participation in a solid waste energy recovery program.

Primary solid waste energy conversion systems include mass burning, processed waste (refuse derived fuel), and modular combustion units.

The M-X operating base and support community could be designed to incorporate a waste-to-energy conversion system. Because of the relatively small waste generation potential (200 to 250 tons/day), a small modular incineration system would be appropriate to produce steam for heating, cooling, and to process heat within the base or the community.

WOOD (6.6.4)

The primary sources of wood waste would be forest residue and mill wastes located in northern California, southwestern Oregon, and eastern Texas. If available, these sources would be sufficient to supply 50 Mwe or more to the M-X system.

Wood cut in the forest has a high moisture content and low energy density. Chipping, drying and pelletizing wood reduces moisture content and increases energy density, so that it becomes transportable for greater distances. Wood pellets can be combusted in conventional boilers having ash handling capabilities.

Environment impacts and concerns with wood energy development are as follows:

1. Harvesting: Removal of trees from a forested area may cause soil erosion, nutrient depletion, aesthetic degradation, reduced water quality, and deterioration of wildlife habitat. However, "weeding out" noncommercial species

and damaged, diseased, or overmature trees is good forest management. It can increase the growth rate of a forest and diversify wildlife habitat.

2. Dust: Fugitive dust from logging roads and from handling and storage of pellets can be a concern.

3. Transportation: A 50 Mwe power plant would require approximately 10,000 pellet trucks per year (38 per working day) entering and exiting the site.

4. Air: Particulate matter from combustion would be the primary concern. Wood has an inherently low sulfur content and thus minimum sulfur dioxide emissions. Likewise its nitrogen oxide emissions are lower than conventional fossil fuels.

5. Water: Power plant cooling water would be required, the same as a conventional plant, unless dry-air cooling towers were incorporated.

METHANOL (6.6.5)

Methanol production is currently derived primarily from the thermochemical conversion of natural gas or refinery light-gas streams. However, any carbonaceous material, such as coal, lignite, wood, and other materials can likewise be converted. The basic steps involve gasification, purification, shift reaction, and methanol synthesis. All processes except gasification are commercially established, but numerous groups are developing the gasification technology.

The primary biomass feedstock for methanol in the M-X region is wood. As with ethanol and wood pelletization, the intention is to produce methanol in the vicinity of the resource and transport it to an energy converstion facility closer to the energy demand.

The primary environmental concerns of energy from alcohol fuels are related to harvesting and transporting large quantities of wood for methanol or large quantities of agricultural crops for ethanol. Alcohol fuels have a positive advantage over fossil fuels since they are completely devoid of sulfur, heavy metals, and particulate matter. They burn at lower temperatures than natural gas or oil, and thus produce lower quantities of nitrogen oxides. Ethanol can be used to extend petroleum products (gasohol and dieselhol) and it can be burned alone with appropriate engine modifications.

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APPENDIX A

Letters from Eletrical Power Utilities

FOURTH STREET AND STEWART AVENUE
P.O. BOX 230 • LAS VEGAS, NEVADA • 89151

April 29, 1981

Ballistic Missile Office
Attn: AFRCE-MX/DEV
Box EIS
Norton Air Force Base, California 92409

Subject: Comments on the MX Deployment Area Selection and Land Withdrawal Acquisition Draft Environmental Impact Statement

Gentlemen:

The electric power utilities affected by the siting of the MX Project in the states of Utah and Nevada have reviewed the MX Deployment Area Selection and Land Withdrawal Acquisition Draft Environmental Impact Statement transmitted by letter dated December 1, 1980. We find that the Draft Statement does not provide sufficient information to allow the individual utilities to plan for either direct MX Project loads or indirect impacts on power requirements due to increased population. We believe that by a commitment of the utilities as outlined below and the cooperation of the Air Force, the problems of power supply to the MX siting area within Utah and Nevada can be resolved. Attached are more specific comments on the Draft Statement.

The electric power utilities affected by the siting of the MX Project in the states of Utah and Nevada have met and concluded the following:

1. The Nevada and Utah utilities will provide the power required for MX facilities within their certified areas.

2. The utilities will coordinate the construction, ownership and maintenance of transmission and distribution facilities required by the Air Force to service the MX missile system. Such facilities will be constructed and maintained to Air Force standards and the cost, therefore, shall be borne by the Air Force.

3. The utilities will form a single "entity" to coordinate with the Air Force during construction and operation of the MX system. The entity will act as a single contact for the operation, maintenance and control of the power utility systems.

4. In answer to the pending Air Force request on transmission system studies, the utilities have agreed to form a committee to work with the Air Force on power transmission system and supply studies.

Nevada Power Company has prepared this letter and is forwarding it on behalf of the below listed utilities:

Boulder City, Nevada
City of St. George, Utah
Dixie-Escalante Rural Electric Power Company
Lincoln County Power District No. 1
Mount Wheeler Power Company
Nevada Power Company
Overton Power District No. 5
Sierra Pacific Power Company
Utah Power & Light Company
Valley Electric Association

Sincerely,

John W. Arlidge
Manager, Special Projects

/gdm
Attachment
cc: Hon. Robert List, Governor, State of Nevada
Hon. Scott E. Matheson, Governor, State of Utah
Nevada MX Project Office
Utah MX Project Office
Lt. Col. Joseph B. Ornowski, USAF, AFRCE-MX/DEES

MX80-NAFB-INC-486

Sierra Pacific Power Company

JOE L. GREMBAN
President

March 10, 1981

The Honorable Caspar Weinberger
Secretary of the Defense
The Pentagon
Washington, D.C. 20301

Re: MX Project Electrical Transmission and Generation Requirements

Dear Mr. Secretary:

This is to express Sierra Pacific Power Company's interest in providing a portion of the electrical supply requirements for the MX Missile Project in Nevada. We feel these requirements can be met with conventional and renewable resource development activity within the State of Nevada to the benefit of the state's residents. We are willing to serve as Project Manager and assume responsibilities for coordinating the MX Project's electrical supply needs among the U.S. Air Force and interested utilities. Further, Sierra's resource development plans can be modified to include MX requirements. This would require timely response and action by the contracting agency to define requirements and arrive at an agreement.

As discussed in this letter, we are in the advanced planning stages for development of conventional coal fired generation, renewable resource based generation and transmission system improvements. These can be integrated with facilities of the other utilities to provide the electrical supply requirements of the MX Project. At the same time these resource facilities can be planned and developed to the benefit of electric customers and the public in the State of Nevada. This action would create a positive attitude among residents and gain public support for the MX Project.

Sierra Pacific Power Company is an electrical utility that serves a 43,000 square mile area of north central Nevada and eastern California. The company is interconnected with Pacific Gas & Electric Company to the west, Idaho Power Company to the north and Utah Power & Light Company to the east. Sierra's existing 230,000 volt transmission line between the Fort Churchill generating station near Yerington, Nevada, and Utah Power & Light Company at the Utah/Nevada stateline near Delta, Utah, currently is the only high voltage transmission line in the MX deployment area. Our service territory contains

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APR 10 1981

HDR-SANTA BARBARA

P. O. BOX 10100 / RENO, NEVADA 89510 / TELEPHONE 702/789-4276

numerous fields of identified geothermal hot water resources that may be applicable for development of electrical generation from renewable energy resources.

Overview: Electrical Supply - Per the MX Project draft EIR (Environmental Impact Report), section 2.3.3.9.2.1-1, "...the induced effect of MX on the total electrical energy situation would be minor, about 1% of the available excess power (1989) in the region. No new generation facilities would have to be supplied besides those previously proposed for the area. These facilities include the Intermountain Power Project, the White Pine Power Project, and the Harry Allen-Warner Valley Energy System."

Electrical utilities are represented by NERC (National Electric Reliability Council), a federation composed of nine regional councils. Sierra Pacific belongs to the WSCC (Western System Coordinating Council) as do most of the utilities west of the Rockies. Quoting from the 1980 NERC report regarding the outlook for energy supplies in the WSCC: "...the utilities within the WSCC region continue to experience problems in constructing the base load generating plants and transmission facilities required to keep pace with the region's projected increase in electric power requirements and to provide an acceptable level of bulk power system reliability. The major reliability concern within the region is the increasing difficulty in acquiring permits to build new generation and transmission facilities due to the regulatory requirements of federal, state and local agencies, and the slow judicial process. Another major concern is the increasing difficulty in obtaining adequate rate increases and financing needed to build new facilities."

This report states that only 500 MW (megawatts) of the 10,700 MW of projected coal fired generation additions for the California-Nevada area in the next ten years are now under construction. And there are many regulatory and environmental problems to be resolved before construction of these units can start. Two of the three facilities named in the MX EIR, the Intermountain Power Project and the White Pine Power Project, are committed to loads that do not include the MX Missile Project. The State of California has announced its intent to oppose the MX Missile Project. Their opposition is based, in part, on concerns about electrical power impacts on California. The projects noted in the Environmental Impact Report have major portions of their energy production committed for delivery to California utilities.

The present peak demand in the vast electrical "desert" represented by Nevada's portion of the MX deployment area is less than 50 MW. The approximately 190 MW peak demand of the MX Missile Project cannot be considered a "minor" problem for the area or for the WSCC. That amount of capacity does not appear to be available from sources presently existing or under construction.

The transmission facilities proposed to supply the MX Missile depend upon the 230 kV interconnection between Sierra Pacific and Utah Power & Light Company. This line is operated at full capacity and the projected MX loads cannot be supplied by the proposed network without major improvements. Further, we have serious concerns about whether the unique operating conditions that result from Nevada's being in the center of the WSCC electrical transmission "doughnut" have been considered in designing the proposed MX transmission system. These problems include large unscheduled flows of power, as well as system disturbances that result in "islanding".

Sierra Pacific's Development Plans - Sierra Pacific is currently constructing two 250 MW units at the North Valmy station in north central Nevada. Each of these units will be 50% owned by Sierra and 50% owned by Idaho Power Company. The first unit is scheduled for on-line operation in October of 1981 and the second in October of 1984. To meet load requirements in the late 1980's Sierra Pacific has completed siting studies for a 1500 MW coal fired generating plant in northern Nevada. It is feasible to permit and construct this plant to meet a 1987-88 "in service" date. We are currently meeting with other companies about their interest in this plant and anticipate finalizing participation by June 1, 1981. With a timely response and expression of interest, the power supply needs of the MX Project could be included in our resource plans. We would also propose to provide the power requirements from start of construction until this new generating source becomes available.

Sierra has been active in developing renewable energy generation resources to reduce its dependence on gas and oil fired generation. A 70 MW solar conversion project is in the final review stages of D.O.E. selection and funding of engineering design. The most promising area for development, however, is in geothermal. Assessment of known geothermal areas conservatively show 400-500 MW of generation available from water dominated heat sources. Design and manufacturing activities have been scheduled to be in operation within two years. Participation in the development of geothermal generation and purchase of energy produced from this resource are open for negotiation.

The electrical energy transmission system needed to transport electricity from the above-mentioned projects to various load centers is under study. We expect to have firm system development plans in place by the end of 1981. The MX Project requirements can be included, provided an expression of interest is made in a timely fashion.

We believe the above points out the basic electrical supply problems and offers a realistic solution for "getting on" with meeting the MX Project's requirements. At the same time, favorable public support can be obtained.

In view of the critical lead times necessary to plan and construct generation and transmission facilities, a commitment to proceed toward orderly development is needed within the next sixty (60) days. To further discuss our mutual interests it is suggested that a meeting be arranged as soon as possible. I will be anticipating an early response.

Sincerely,

Joe L. Gremban

Joe L. Gremban

JLG/lb

cc: Mr. James B. Edwards
Secretary, Department of Energy
Washington, D.C. 20545

Mr. Verne Orr
Secretary of the Air Force
The Pentagon
Washington, D.C. 20330

Lt. Col. Louis Montulli - HQ USAF RD-M
Office of Special Assistance for MX Matters
Room 5E373
The Pentagon
Washington, D.C. 20330

The Honorable Howard W. Cannon
Senator from Nevada
259 Senate Office Building
Washington, D.C. 20510

The Honorable Paul Laxalt
Senator from Nevada
315 Russell Building
Washington, D.C. 20510

The Honorable James Santini
Congressman from Nevada
1408 Longworth House Office Building
Washington, D.C. 20515

The Honorable Robert List
Governor of Nevada
State Capitol Building
Carson City, Nevada 89701

cc: Mr. John Arlidge
Assistant to the Vice President
Nevada Power Company
P.O. Box 230
Las Vegas, Nevada 89151

Mr. Dean L. Bryner
Vice President, System Resource Development
Utah Power & Light Company
P.O. Box 899
Salt Lake City, Utah 84110

APPENDIX B

Memorandum of Understanding Between the Department of Defense and the Department of Energy on the M-X Renewable Energy Systems Project

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE DEPARTMENT OF DEFENSE

AND

THE DEPARTMENT OF ENERGY

ON

THE M-X RENEWABLE ENERGY SYSTEMS PROJECT

I. Purpose

This Memorandum of Understanding (MOU) sets forth the general conditions under which the Department of Defense (DoD) and the Department of Energy (DoE) will undertake cooperative activities in the conduct of the M-X Renewable Energy Systems (M-X/RES) Project.

II. Scope of Cooperative Effort

On 7 September 1979, the President formally approved the full scale development of the M-X Missile System. Subsequently, DoD and DoE announced their intention to pursue a joint project to use renewable energy systems (RES) to satisfy M-X ground power needs and to help accelerate the development of clean, commercially affordable, non-fossil fuel energy systems. In this context:

A. DoE and DoD will seek to identify and to develop RES alternatives capable of providing reliable power to the M-X missile system complex;

B. DoD will use its expert capabilities and facilities as mutually agreed in research and development programs in support of DoE, within its authority and in accordance with DoD policies and procedures;

C. DoE will use its expert capabilities and faciltiies as mutually agreed in research and development programs in support of DoD, within its authority and in accordance with DoE policies and procedures;

D. DoE will identify the significant potential of RES and will advise DoD of advances in RES and related RES technologies that have applicability to DoD M-X planning, development, and implementation efforts;

E. DoE will assure activities related to M-X/RES avoid duplication of other on-going RES effort.

The authority for entering into this agreement includes, for the DoD, 10 USC § 2358 (1976) (research and development programs), 31 USC § 686 (1976) (Economy Act), and, for the DoE, the Energy Reorganization Act of 1974, Department of Energy Organization Act, and the Federal Nonnuclear Energy Research and Development Act of 1974.

III. Implementation

The Secretary of Energy and the Secretary of Defense will each designate a Program Coordinator who will serve as the principal liaison officers between the two departments. The Program Coordinators, using a joint DoD-DoE M-X/RES Coordinating Council, will conduct reviews of cooperative efforts at least semiannually and will report recommendations based on these reviews to the Secretary of Defense and the Secretary of Energy as required. The joint DoD-DoE M-X/RES Coordinating Council will be chaired by the two Program Coordinators and consist of members designated by the Program Coordinators. Specific programs and projects will be undertaken as agreed by DoD and DoE.

An M-X/RES Project Office will be established and staffed by both departments to assist the Program Coordinators in implementing this MOU. As directed by the Coordinating Council, this Project Office shall draft and recommend to DoD and DoE joint management, technical, and budgetary plans for the project consistent with the project objectives and guidance of the M-X/RES Coordinating Council. The M-X/RES Project Office shall consist of a Project Manager from DoE, and a Deputy Manager from the Department of the Air Force.

IV. Procurement Policy

Activities undertaken in furtherance of this MOU may involve contractual arrangements with non-governmental entities. Contracting will be done in accordance with the regulations of the contracting department. The department for whom the activities are undertaken will identify any of its policy requirements with which such arrangements must be consistent.

When any of the requirements of the department for whom the activities are undertaken are in conflict with regulations, procedures, or policy of, or legislation applicable to, the contracting department, the issue will be resolved jointly at appropriate levels within the two departments.

DoE patent policy set forth in 41 CFR part 9-9 shall apply to any research, development, or demonstration work under this Memorandum of Understanding that is contracted for by DoE; and DoD patent policy set forth in Defense Acquisition Regulation part IX shall apply to work contracted for by DoD. Where conflicts arise, the issues will be resolved at appropriate levels within the two

departments. Rights to inventions made by U.S. Government employees (both civilian and military) of either DoD or DoE shall be determined in accordance with the policy of the employing Department.

V. Information Coordination

Consistent with existing data disclosure policies, there will be a free exchange of information between the DoE and DoD, and the two departments will coordinate information systems to assure consistent information development and use. Except for requests made under the Freedom of Information Act, 5 USC § 522 (1976), arrangements for timely release of information to the public regarding projects and programs implemented under this MOU shall be by mutual agreement between the DoE and DoD.

VI. Amendment and Termination

This MOU will be reviewed annually by DoE and DoD to determine whether it should be continued, modified, or terminated. This MOU may be terminated or amended by mutual agreement of DoE and DoD. It may be terminated by either party with a minimum of 90 days advance notice. This MOU will terminate on December 30, 1983, unless renewed by action of the signatories.

VII. Effective Date

This MOU is effective when signed by both departments.

C W Duncan Jr	Harold Brown
Charles W. Duncan, Jr. Secretary of Energy	Harold Brown Secretary of Defense
January 16, 1981 Date	January 15, 1981 Date

APPENDIX C

Supporting Data

APPENDIX C

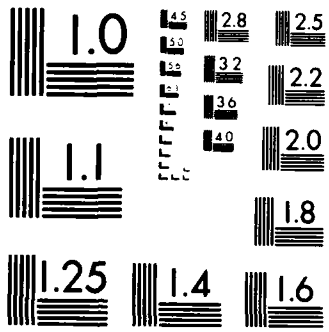
The following data illustrates the M-X secondary impacts on electrical demand and annual consumption of electricity, heating oil, and natural gas. This is used by M-X-induced personnel (direct and indirect) in the local communities and does not reflect use by construction camps, the DDA, operating bases, or other technical operations. Illustrative data for Nevada/Utah and Texas/New Mexico regions is for the Proposed Action and for alternative 7. Similar data for other alternatives was analyzed but is not shown here to reduce the bulk of this ETR. Electrical peak demands shown represent a "worst case" analysis. Actual electrical peak demands will be approximately 78 percent of those shown.

PROPOSED ACTION FULL DEPLOYMENT - NEVADA/UTAH
BASE I AT COYOTE SPRING, NV (CLARK CO.)
BASE II AT MILFORD, UT (BEAVER CO.)

AD-A149 915 DEPLOYMENT AREA SELECTION AND LAND WITHDRAWAL/ACQUISITION M-X/MPS (M-X/MU..(U) HENNINGSON DURHAM AND RICHARDSON SANTA BARBARA CA 02 OCT 81 3/3

UNCLASSIFIED M-X-ETR-24 F/G 10/2 NL

END



MICROCOPY RESOLUTION TEST CHART
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POPULATION

Clark County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	790	3522	6302	4517	2422	1352	996	685	280	0	0	0	0
BASE CAMPS	117	942	983	1087	710	625	625	625	125	0	0	0	0
COMMUNITIES	344	9249	14250	15512	8510	5458	4289	2752	428	0	0	0	0
OPERATIONS BASE	0	72	354	4146	9395	12666	12666	12666	12666	12666	12666	12666	12666
COMMUNITIES	0	138	1115	12422	22822	23332	16231	7091	3386	3665	3962	4279	4616
TOTAL	1250	13923	23003	37685	43859	43431	34806	23819	16885	16331	16628	16945	17282

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Clark County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	1922	8571	15334	10991	5894	3289	2423	1666	681	0	0	0	0
BASE CONSTRUCTION	837	22505	34674	37746	20708	13280	10435	6697	1041	0	0	0	0
OPERATIONS	0	336	2712	30227	55534	56773	39494	17255	8239	8918	9641	10412	11232
TOTAL	2759	31412	52720	78963	82136	73342	52353	25618	9962	8918	9641	10412	11232

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Clark County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7487	33382	59726	42809	22958	12811	9439	6488	2654	0	0	0	0
BASE CONSTRUCTION	3260	87654	135051	147017	80656	51724	40645	26086	4056	0	0	0	0
OPERATIONS	0	1310	10563	117731	216301	221128	153826	67206	32091	34735	37550	40554	43748
TOTAL	10748	122346	205341	307556	319915	285663	203910	99780	38801	34735	37550	40554	43748

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Clark County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	108	482	862	618	331	185	136	94	38	0	0	0	0
BASE CONSTRUCTION	47	1265	1948	2121	1164	746	586	376	59	0	0	0	0
OPERATIONS	0	19	152	1699	3121	3190	2219	970	463	501	542	585	631
TOTAL	155	1765	2963	4437	4616	4121	2942	1440	560	501	542	585	631

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Clark County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Eureka County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	70	402	951	2088	1539	25	0	0	0	0
COMMUNITIES	1	3	8	304	1718	4273	9149	7385	1077	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	53	1	0	0
TOTAL	1	3	8	373	2119	5224	11236	8924	1102	53	1	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Eureka County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3.	8	21.	803.	4540.	11293.	24179.	19517.	2846.	0.	0	0	0.
BASE CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0	0.	0.	0	0	0
OPERATIONS	0.	0	0.	0.	0	0.	0	0.	0.	140.	3.	0.	0
TOTAL	3	8.	21	803.	4540.	11293.	24179.	19517.	2846.	140.	3.	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Eureka County, Nv.	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	11.	32	86.	3274.	18502	46018.	98530.	79532.	11599.	0.	0.	0.	0.
BASE CONSTRUCTION	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
OPERATIONS	0.	0.	0.	0.	0.	0.	0.	0	0.	571.	11	0.	0.
TOTAL	11.	32	86.	3274.	18502.	46018.	98530.	79532.	11599.	571.	11	0.	0.

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Eureka County, Nv.	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0.	1.	2.	65.	366.	910.	1948.	1572.	229.	0.	0.	0.	0.
BASE CONSTRUCTION	0	0	0.	0.	0.	0	0.	0.	0.	0.	0	0	0
OPERATIONS	0.	0	0.	0.	0.	0.	0.	0.	0	11.	0	0	0
TOTAL	0.	1.	2.	65.	366.	910.	1948.	1572.	229.	11	0.	0.	0

TOTAL ANNUAL GAS USAGE(10**3 CU. FT) OF POPULATION LIVING IN COMMUNITIES

Eureka County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0.	0.	0	0.	0	0	0	0.	0	0.	0
BASE CONSTRUCTION	0	0	0	0	0.	0	0	0	0.	0	0	0	0
OPERATIONS	0	0	0.	0.	0	0.	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0.	0.	0.	0	0	0	0

POPULATION

Lincoln County, Nv		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	100	455	977	2346	1730	150	0	0	0	0	0	0	0
	COMMUNITIES	452	2112	4710	10626	8950	2237	630	209	2	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	156	356	375	391	327	311	132	113	23	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	6	27	379	889	1436	1149	992	987	987	986	986	985
TOTAL		707	2929	6090	13742	11894	4133	1911	1313	1012	987	987	986	986

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Lincoln County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	1100	5140	11462.	25857	21778	5443	1533	508	5	0.	0	0.	0.
BASE CONSTRUCTION	380	866.	913.	952.	797	757	320	276.	56.	0	0	0	0
OPERATIONS	0.	14	67	921.	2162.	3495.	2797	2413	2402	2402.	2399	2399	2397
TOTAL	1479	6020.	12441.	27730	24737	9694	4650	3197	2463.	2402	2399.	2399	2397.

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Lincoln County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	4283	20021.	44643.	100710.	84823	21199.	5971.	1979	19.	0.	0	0.	0
BASE CONSTRUCTION	1479.	3371	3556.	3709.	3103	2948.	1247.	1075.	218.	0.	0	0.	0.
OPERATIONS	0.	56.	260.	3588.	8423	13611.	10893.	9400.	9354.	9354.	9345.	9345.	9335
TOTAL	5762.	23447	48459.	108006.	96349	37759	18112.	12454.	9591.	9354.	9345	9345.	9335

TOTAL ANNUAL OIL USEAGE(10**3 GALS.) OF POPULATION LIVING IN COMMUNITIES

Lincoln County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	62.	289.	644.	1453.	1224	306.	86	29.	0.	0.	0.	0.	0
BASE CONSTRUCTION	21.	49.	51.	54	45.	43.	18.	16.	3.	0.	0.	0.	0
OPERATIONS	0.	1	4.	52.	122	196.	157	136	135.	135.	135	135.	135
TOTAL	83.	338.	699.	1558.	1390	545.	261	180	138.	135.	135.	135	135

TOTAL ANNUAL GAS USAGE(10**3 CU. FT.) OF POPULATION LIVING IN COMMUNITIES

Lincoln County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0.	0	0	0	0	0.	0	0.	0.	0	0	0.
BASE CONSTRUCTION	0	0	0	0.	0.	0	0	0	0	0.	0	0.	0
OPERATIONS	0	0	0	0.	0	0	0.	0	0.	0.	0.	0	0
TOTAL	0	0	0.	0	0	0	0	0	0.	0.	0	0	0

POPULATION

Nye County, Nv		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	71	289	941	1884	3582	5000	2922	1197	13	0	0	0	0
	COMMUNITIES	250	1050	3490	7823	14852	21793	15665	7949	1218	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	58	0	0	0
TOTAL		321	1339	4431	9707	18433	26793	18586	9145	1230	58	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Nye County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	608	2555	8492	19036	36139	53029	38118	19342	2964	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	141	0	0	0
TOTAL	608	2555	8492	19036	36139	53029	38118	19342	2964	141	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Nye County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2369	9951	33077	74143	140761	206544	148466	75337	11544	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	550	0	0	0
TOTAL	2369	9951	33077	74143	140761	206544	148466	75337	11544	550	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS.) OF POPULATION LIVING IN COMMUNITIES

Nye County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	34	144	477	1070	2031	2980	2142	1087	167	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	8	0	0	0
TOTAL	34	144	477	1070	2031	2980	2142	1087	167	8	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT.) OF POPULATION LIVING IN COMMUNITIES

Nye County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

White Pine County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0.	5.	148	632	1515.	1213.	13.	0.	0	0	0
COMMUNITIES	0	0.	224.	706.	2046.	4800.	8586.	7099.	887.	0.	0.	0.	0
BASE CAMPS	0	0	0.	0	0	0	0.	0.	0.	0.	0	0	0
COMMUNITIES	0	0	0.	0.	0	0.	0.	0.	0.	0.	0	0.	0.
OPERATIONS BASE	0	0	0.	0.	0	0	0.	0.	0.	0.	0	0.	0.
COMMUNITIES	0	0.	0.	0.	0	0	0.	0	0.	0.	0	0	0.
TOTAL	0	0.	224.	710.	2193.	5431.	10102.	8312.	899.	0.	0.	0.	0.

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

White Pine County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	592	1866	5407	12686	22691	18762	2344	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	592	1866	5407	12686	22691	18762	2344	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

White Pine County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	2412	7603	22034	51693	92466	76452	9552	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	2412	7603	22034	51693	92466	76452	9552	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

White Pine County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	48	150	436	1022	1828	1512	189	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	48	150	436	1022	1828	1512	189	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

White Pine County, Nv	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Beaver County, UT		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	43	208	462	912	944	163	0	0	0	0	0	0	0
	COMMUNITIES	166	799	2860	5706	6842	1902	140	0	0	0	0	0	0
BASE	CAMPS	0	0	87	930	1066	959	344	0	0	0	0	0	0
	COMMUNITIES	0	0	390	4188	5776	5670	1523	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	53	335	3095	6779	8414	8414	8414	8414	8414	8414
	COMMUNITIES	0	0	0	45	497	5026	8138	7167	4923	4219	4218	4217	4217
TOTAL		210	1007	3799	11834	15459	16813	16923	15581	13336	12633	12632	12631	12630

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Beaver County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	426	2051	7342	14645	17560	4882	359	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	1000	10750	14825	14552	3909	0	0	0	0	0	0
OPERATIONS	0	0	0	115	1277	12901	20887	18395	12635	10829	10826	10823	10823
TOTAL	426	2051	8342	25510	33661	32334	25155	18395	12635	10829	10826	10823	10823

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Beaver County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	1659	7985	28596	57023	68371	19008	1397	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	3893	41855	57723	56659	15222	0	0	0	0	0	0
OPERATIONS	0	0	0	447	4971	50231	81327	71624	49198	42163	42153	42143	42143
TOTAL	1659	7985	32479	99326	131065	125898	97947	71624	49198	42163	42153	42143	42143

TOTAL ANNUAL OIL USEAGE(10**3 GALS.) OF POPULATION LIVING IN COMMUNITIES

Beaver County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	31	149	535	1066	1279	355	26	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	73	783	1079	1059	285	0	0	0	0	0	0
OPERATIONS	0	0	0	8	93	939	1521	1339	920	788	788	788	788
TOTAL	31	149	607	1857	2451	2354	1832	1339	920	788	788	788	788

TOTAL ANNUAL GAS USAGE(10**3 CU. FT.) OF POPULATION LIVING IN COMMUNITIES

Beaver County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Iron County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1971	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	151	588	704	125	0	0	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	71	1498	1996	1788	450	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	12	97	1091	2613	2893	2727	2689	2681	2674	2668
TOTAL	0	0	222	2097	2796	3003	3063	2893	2727	2689	2681	2674	2668

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Iron County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	338	1506	1804	320	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	181	3837	5113	4582	1152	0	0	0	0	0	0
OPERATIONS	0	0	0	32	248	2794	6694	7411	6986	6888	6868	6850	6835
TOTAL	0	0	569	5375	7165	7695	7847	7411	6986	6888	6868	6850	6835

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Iron County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	1495	5807	6959	1232	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	698	14798	19717	17669	4443	0	0	0	0	0	0
OPERATIONS	0	0	0	122	956	10777	25818	28581	26941	26566	26487	26418	26358
TOTAL	0	0	2193	20727	27633	29678	30261	28581	26941	26566	26487	26418	26358

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Iron County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	27	107	128	23	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	13	272	362	325	82	0	0	0	0	0	0
OPERATIONS	0	0	0	2	18	198	474	525	495	488	487	485	484
TOTAL	0	0	40	381	508	545	556	525	495	488	487	485	484

TOTAL ANNUAL GAS USAGE(10**3 CU. FT.) OF POPULATION LIVING IN COMMUNITIES

Iron County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Juab County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	65	177	638	1282	1344	931	0	0	0	0	0
COMMUNITIES	0	28	333	799	1967	3457	3374	2256	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	115	0	0	0	0
TOTAL	0	28	398	976	2604	4739	4718	3188	115	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Juab County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	75	887	2129	5241	9212	8990	6011	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	306	0	0	0	0
TOTAL	0	75	887	2129	5241	9212	8990	6011	306	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Juab County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	279.	3317.	7958	19592	34433.	33606	22470.	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	1145.	0	0	0	0
TOTAL	0	279.	3317	7958	19592	34433.	33606	22470	1145	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Juab County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	5	62	148	365	641.	626.	419.	0.	0	0.	0.	0.
BASE CONSTRUCTION	0	0	0.	0	0	0.	0.	0	0.	0.	0.	0.	0
OPERATIONS	0	0	0	0	0	0.	0.	0	21.	0.	0.	0	0
TOTAL	0	5	62	148	365.	641.	626.	419.	21.	0.	0	0.	0

TOTAL ANNUAL GAS USAGE(10**3 CU. FT.) OF POPULATION LIVING IN COMMUNITIES

Juab County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0.	0.	0.	0.	0	0.	0.	0	0.	0.	0	0.	0
BASE CONSTRUCTION	0	0	0.	0	0	0.	0.	0.	0	0.	0	0.	0
OPERATIONS	0	0.	0.	0	0	0.	0	0.	0	0	0.	0.	0
TOTAL	0	0	0	0	0	0.	0.	0	0.	0.	0.	0.	0

POPULATION

Millard County, Ut		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	91	401	949.	1886.	1916.	1276.	263.	0.	0.	0	0.	0.	0
	COMMUNITIES	299	1329	3239.	6489.	7015	5603.	2631.	1173.	0	0.	0.	0.	0
BASE	CAMPS	0	0	0.	0	0	0.	0.	0.	0.	0.	0.	0.	0
	COMMUNITIES	0	0	17.	182	209.	189.	76	0.	0	0.	0	0.	0
OPERATIONS	BASE	0	0	0.	0.	0	0.	0	0	0.	0.	0	0.	0.
	COMMUNITIES	0	0.	0.	0.	0	0.	0.	0.	49.	0.	0.	0.	0
TOTAL		391	1730	4204.	8558.	9140	7067.	2969.	1173.	49.	0.	0.	0	0.

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Millard County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	797	3541	8631	17291	18692	14930	7011	3126	0	0	0	0	0
BASE CONSTRUCTION	0	0	45	485	557	504	202	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	131	0	0	0	0
TOTAL	797	3541	8676	17776	19249	15433	7213	3126	131	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Millard County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2978	13237	32261	64632	69871	55807	26206	11683	0	0	0	0	0
BASE CONSTRUCTION	0	0	169	1813	2082	1883	757	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	488	0	0	0	0
TOTAL	2978	13237	32431	66445	71953	57690	26962	11683	488	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Millard County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	55	247	601	1204	1302	1040	488	218	0	0	0	0	0
BASE CONSTRUCTION	0	0	3	34	39	35	14	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	9	0	0	0	0
TOTAL	55	247	604	1238	1340	1075	502	218	9	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU. FT) OF POPULATION LIVING IN COMMUNITIES

Millard County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Salt Lake/Utah COs - Ut		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	798	972	1148	2656	6213	7237	6274	1691	280	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		798	972	1148	2656	6213	7236	6274	1691	280	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Salt Lake/Utah COs , Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2126	2590	3059	7077	16555	19284	16718	4506	746	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2126	2590	3059	7077	16555	19284	16718	4506	746	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Salt Lake/Utah COs , Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7948	9681	11434	26455	61883	72083	62491	16843	2789	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7948	9681	11434	26455	61883	72083	62491	16843	2789	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Salt Lake/Utah COs , Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	148	180	213	493	1153	1343	1164	314	52	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	148	180	213	493	1153	1343	1164	314	52	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Salt Lake/Utah COs , Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

POPULATION

Washington County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	24	308	513	530	0	0	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	520	425	262	217	210	205	200
TOTAL	0	0	24	308	513	530	520	425	262	217	210	205	200

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Washington County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	61	789	1314	1358	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	1332	1089	671	556	538	525	512
TOTAL	0	0	61	789	1314	1358	1332	1089	671	556	538	525	512

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Washington County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	237	3043	5068	5236	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	5137	4199	2588	2144	2075	2025	1976
TOTAL	0	0	237	3043	5068	5236	5137	4199	2588	2144	2075	2025	1976

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Washington County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	4	56	93	96	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	94	77	48	39	38	37	36
TOTAL	0	0	4	56	93	96	94	77	48	39	38	37	36

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Washington County, Ut	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ELECTRICAL DEMAND / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

NEVADA	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	4	16	36	59	74	86	89	60	9	0	0	0	0
BASE CONSTRUCTION	1	23	36	39	22	14	11	7	1	0	0	0	0
OPERATIONS	0	0	3	31	58	60	42	20	11	12	12	13	14
TOTAL	5	40	74	128	153	160	142	86	21	12	12	13	14

UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3	8	20	43	61	50	33	14	1	0	0	0	0
BASE CONSTRUCTION	0	0	1	15	20	20	5	0	0	0	0	0	0
OPERATIONS	0	0	0	0	2	16	29	27	21	18	18	18	18
TOTAL	3	8	22	59	83	85	67	41	21	18	18	18	18

NEVADA AND UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	25	56	102	135	136	122	73	10	0	0	0	0
BASE CONSTRUCTION	1	23	37	54	42	34	16	7	1	0	0	0	0
OPERATIONS	0	0	3	31	59	76	71	47	31	30	30	31	32
TOTAL	8	48	96	187	236	245	209	127	42	30	30	31	32

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL ELECTRICAL USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

NEVADA	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	14	63	140	229	289	338	355	240	35	0	0	0	0
BASE CONSTRUCTION	5	91	139	151	84	55	42	27	4	0	0	0	0
OPERATIONS	0	1	11	121	225	235	165	77	41	45	47	50	53
TOTAL	19	156	289	501	598	628	561	344	81	45	47	50	53

UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	13	31	77	165	232	188	124	51	3	0	0	0	0
BASE CONSTRUCTION	0	0	5	58	80	76	20	0	0	0	0	0	0
OPERATIONS	0	0	0	1	6	61	112	104	80	71	71	71	70
TOTAL	13	31	82	224	317	325	256	155	83	71	71	71	70

NEVADA AND UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	27	95	217	393	521	526	479	291	38	0	0	0	0
BASE CONSTRUCTION	5	91	143	209	163	131	62	27	4	0	0	0	0
OPERATIONS	0	1	11	122	231	296	277	181	122	116	118	120	124
TOTAL	31	187	371	725	915	953	818	499	164	116	118	120	124

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL OIL USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

NEVADA	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	1	2	3	4	5	6	4	1	0	0	0	0
BASE CONSTRUCTION	0	1	2	2	1	1	1	0	0	0	0	0	0
OPERATIONS	0	0	0	2	3	3	2	1	1	1	1	1	1
TOTAL	0	2	4	7	9	10	9	6	1	1	1	1	1

UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	1	1	3	4	3	2	1	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	1	1	1	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	1	2	2	1	1	1	1	1
TOTAL	0	1	2	4	6	6	5	3	2	1	1	1	1

NEVADA AND UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	1	3	6	9	9	8	5	1	0	0	0	0
BASE CONSTRUCTION	0	1	2	3	3	2	1	0	0	0	0	0	0
OPERATIONS	0	0	0	2	3	5	4	3	2	2	2	2	2
TOTAL	1	3	6	11	15	16	14	9	3	2	2	2	2

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL GAS USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

NEVADA	1982	1983	1984	1985	1986	1987	1988	1989	1990	1971	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1971	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

NEVADA AND UTAH	1982	1983	1984	1985	1986	1987	1988	1989	1990	1971	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

ALTERNATIVE 7 FULL DEPLOYMENT - TEXAS/NEW MEXICO
BASE I AT CLOVIS, NM (CURRY CO.)
BASE II AT DALHART, TX (HARTLEY CO.)

POPULATION

Bailey County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	35	199	522	856	1087	171	0	0	0	0	0	0	0
	COMMUNITIES	81	466	1227	2041	2677	882	297	191	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	141	288	315	317	272	279	149	120	48	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	2	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		256	952	2063	3234	4036	1352	445	309	47	2	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Bailey County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	145	834	2197	3655	4793	1579	532	343	0	0	0	0	0
BASE CONSTRUCTION	252	516	554	603	487	499	267	214	86	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	4	0	0	0
TOTAL	398	1350	2761	4258	5280	2079	799	557	86	4	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Bailey County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	572	3290	8462	14409	18899	6227	2096	1352	0	0	0	0	0
BASE CONSTRUCTION	995	2033	2[illegible]24	2379	1921	1969	1053	844	339	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	14	0	0	0
TOTAL	1567	5323	10[illegible]86	16788	20820	8196	3149	2196	339	14	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Bailey County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Bailey County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	875	5033	13252	22043	2[illegible]911	9527	3206	2068	0	0	0	0	0
BASE CONSTRUCTION	1523	3110	3402	3640	2938	3012	1610	1291	518	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	22	0	0	0
TOTAL	2378	8143	16654	25633	31850	12539	4817	3359	518	22	0	0	0

POPULATION

Castro County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	24	98	221	724	980	0	0	0	0	0
	COMMUNITIES	0	0	28	136	406	804	1995	2564	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	357	10	0	0	0
TOTAL		0	0	28	159	504	1024	2719	3544	357	10	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Castro County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	50	244	727	1440	3572	4591	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	639	18	0	0	0
TOTAL	0	0	50	244	727	1440	3572	4591	639	18	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Castro County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	198	960	2866	5676	14084	18101	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	2520	71	0	0	0
TOTAL	0	0	198	960	2866	5676	14084	18101	2520	71	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Castro County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Castro County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	102	1469	4385	8683	21546	27692	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	3856	108	0	0	0
TOTAL	0	0	102	1469	4385	8683	21546	27692	3856	108	0	0	0

POPULATION

Cochran County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	13	90	227	474	657	227	0	0	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	59	27	3	0	0	0	0
TOTAL	13	90	227	474	657	226	59	27	3	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Cochran County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	23	161	406	849	1176	406	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	106	48	5	0	0	0	0
TOTAL	23	161	406	849	1176	406	106	48	5	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Cochran County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	92	635	1603	3346	4638	1603	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	417	191	21	0	0	0	0
TOTAL	92	635	1603	3346	4638	1603	417	191	21	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS.) OF POPULATION LIVING IN COMMUNITIES

Cochran County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Cochran County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	140	972	2452	5119	7096	2452	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	637	292	32	0	0	0	0
TOTAL	140	972	2452	5119	7096	2452	637	292	32	0	0	0	0

POPULATION

Dallam County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	127	523	1656	1538	2589	1842	80	0	0	0	0	0
	COMMUNITIES	1	540	2545	7165	8499	11671	8543	953	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	72	721	997	800	316	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	12	187	1021	2788	5946	5077	3277	2866	2851	2851
TOTAL		1	666	3140	9554	11221	16080	13489	6978	5077	3277	2866	2850	2850

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Dallam County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2	967	4557	12830	15219	20898	15298	1706	0	0	0	0	0
BASE CONSTRUCTION	0	0	129	1291	1785	1432	567	0	0	0	0	0	0
OPERATIONS	0	0	0	21	336	1829	4972	10647	9091	5904	5132	5105	5105
TOTAL	2	967	4696	14142	17340	24159	20857	12353	9091	5904	5132	5105	5105

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Dallam County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	3812	17968	50584	60005	82395	60316	6727	0	0	0	0	0
BASE CONSTRUCTION	0	0	508	5092	7040	5647	2234	0	0	0	0	0	0
OPERATIONS	0	0	0	83	1323	7210	19684	41979	35843	23276	20234	20128	20128
TOTAL	7	3812	18476	55759	68368	95252	82233	48706	35843	23276	20234	20128	20128

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Dallam County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Dallam County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	11	5832	27487	77383	91795	126048	92271	10291	0	0	0	0	0
BASE CONSTRUCTION	0	0	777	7790	10769	8639	3418	0	0	0	0	0	0
OPERATIONS	0	0	0	127	2025	11029	30112	64219	54832	35608	30953	30791	30791
TOTAL	11	5832	28264	85300	104589	145716	125800	74510	54832	35608	30953	30791	30791

POPULATION

Deaf Smith County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	72	268	657	1246	1705	970	50	0	0	0	0
	COMMUNITIES	0	0	204	896	2119	3842	5218	3629	486	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL		0	0	276	1164	2776	5089	6923	4599	536	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Deaf Smith County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	365	1604	3794	6879	9343	6498	870	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	365	1604	3794	6879	9343	6498	870	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Deaf Smith County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	1440.	6326	14960.	27124.	36838.	25620	3431.	0	0	0	0
BASE CONSTRUCTION	0	0	0.	0	0.	0.	0.	0	0.	0.	0	0.	0
OPERATIONS	0	0	0	0.	0.	0.	0.	0	0	0	0.	0	0
TOTAL	0	0	1440.	6326	14960.	27124.	36838.	25620	3431.	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Deaf Smith County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0.	0	0.	0.	0	0.	0.	0.	0	0.	0
BASE CONSTRUCTION	0	0	0.	0	0.	0.	0.	0.	0.	0.	0	0	0
OPERATIONS	0	0	0.	0	0.	0.	0.	0	0.	0.	0.	0.	0
TOTAL	0	0	0.	0	0.	0.	0.	0	0.	0.	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Deaf Smith County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	2203.	9677	22886	41494	56355	39194	5249	0	0	0	0
BASE CONSTRUCTION	0	0	0.	0	0	0	0	0	0	0.	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	2203	9677	22886	41494	56355	39194	5249	0	0	0	0

POPULATION

Hale County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	55	205	320	308	0	0	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	347	310	1	0	0	0	0
TOTAL	0	0	55	205	320	308	347	310	1	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Hale County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	98	367	573	552	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	621	555	2	0	0	0	0
TOTAL	0	0	98	367	573	552	621	555	2	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Hale County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	388	1447	2259	2174	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	2450	2189	7	0	0	0	0
TOTAL	0	0	388	1447	2259	2174	2450	2189	7	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Hale County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Hale County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	594	2214	3456	3326	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	3748	3348	11	0	0	0	0
TOTAL	0	0	594	2214	3456	3326	3748	3348	11	0	0	0	0

POPULATION

Hartley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	236	522	855	895	873	0	0	0	0	0	0	0
COMMUNITIES	1	648	2144	4290	5003	4938	1182	145	0	0	0	0	0
BASE CAMPS	0	0	90	939	1070	975	359	0	0	0	0	0	0
COMMUNITIES	0	0	323	3660	4741	3888	1207	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	50	317	2923	6403	7947	7947	7947	7947	7947	7947
COMMUNITIES	0	0	0	40	396	2651	5142	3743	3146	3146	3146	3146	3146
TOTAL	1	884	3078	9833	12429	16246	14373	11835	11093	11093	11093	11093	11093

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Hartley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
PDA CONSTRUCTION	2	1160	3839	7681	8959	8041	2116	260	0	0	0	0	0
BASE CONSTRUCTION	0	0	579	6553	8489	6963	2305	0	0	0	0	0	0
OPERATIONS	0	0	0	71	709	4747	9208	6701	5633	5633	5633	5633	5633
TOTAL	2	1160	4417	14305	18157	20551	13628	6962	5633	5633	5633	5633	5633

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Hartley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
PDA CONSTRUCTION	7	4575	15135	30284	35322	34858	8342	1027	0	0	0	0	0
BASE CONSTRUCTION	0	0	2282	25836	33470	27451	9088	0	0	0	0	0	0
OPERATIONS	0	0	0	281	2795	18716	36303	26422	22210	22210	22210	22210	22210
TOTAL	7	4575	17417	56401	71587	81026	53733	27449	22210	22210	22210	22210	22210

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Hartley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
PDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Hartley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
PDA CONSTRUCTION	11	6998	23153	46329	54035	53326	12761	1571	0	0	0	0	0
BASE CONSTRUCTION	0	0	3491	39523	51203	41995	13902	0	0	0	0	0	0
OPERATIONS	0	0	0	431	4276	28632	55536	40420	33977	33977	33977	33977	33977
TOTAL	11	6998	26644	86282	109513	123953	82200	41991	33977	33977	33977	33977	33977

POPULATION

Hockley County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	13	60	152	279	372	207	0	0	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	125	83	18	1	0	0	0
TOTAL		12	60	151	279	371	208	125	83	18	1	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Hockley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	23	107	272	500	666	371	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	224	149	32	2	0	0	0
TOTAL	23	107	272	500	666	371	224	149	32	2	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Hockley County, Tx	1982	1983	1984	1965	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	92	424	1073	1970	2626	1461	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	882	586	127	7	0	0	0
TOTAL	92	424	1073	1970	2626	1461	882	586	127	7	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Hockley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Hockley County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	140	648	1642	3013	4018	2236	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	1350	896	194	11	0	0	0
TOTAL	140	648	1642	3013	4018	2236	1350	896	194	11	0	0	0

POPULATION

Lamb County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	16	78	214	371	533	404	371	302	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	48	3	0	0	0
TOTAL		15	78	213	370	532	403	372	301	48	3	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Lamb County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	29	140	383	664	954	723	664	541	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	86	5	0	0	0
TOTAL	29	140	383	664	954	723	664	541	86	5	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Lamb County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	113	551	1511	2619	3763	2052	2619	2132	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	339	21	0	0	0
TOTAL	113	551	1511	2619	3763	2852	2619	2132	339	21	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Lamb County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Lamb County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	173	842	2311	4007	5756	4363	4007	3262	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	518	32	0	0	0
TOTAL	173	842	2311	4007	5756	4363	4007	3262	518	32	0	0	0

POPULATION

Lubbock County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	293	931	1801	3409	4692	4310	0	0	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	3705	3071	1750	1377	1359	1359	1359
TOTAL		293	930	1800	3409	4692	4310	3705	3071	1750	1377	1359	1359	1359

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Lubbock County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	525	1667	3225	6104	8401	7717	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	6634	5499	3134	2466	2433	2433	2433
TOTAL	525	1667	3225	6104	8401	7717	6634	5499	3134	2466	2433	2433	2433

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Lubbock County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2069	6573	12715	24067	33125	30428	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	26157	21681	12355	9721	9594	9594	9594
TOTAL	2069	6573	12715	24067	33125	30428	26157	21681	12355	9721	9594	9594	9594

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Lubbock County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Lubbock County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3164	10055	19451	36818	50674	46549	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	40015	33167	18900	14872	14677	14677	14677
TOTAL	3164	10055	19451	36818	50674	46549	40015	33167	18900	14872	14677	14677	14677

POPULATION

Moore County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	4	161	462	1037	1137	1325	536	21	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	53	578	738	618	216	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	8	103	592	1437	1493	1282	1253	1252	1252	1252
TOTAL		4	161	514	1622	1978	2533	2191	1513	1282	1252	1251	1251	1251

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Moore County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	288	828	1857	2036	2372	960	37	0	0	0	0	0
BASE CONSTRUCTION	0	0	94	1035	1322	1106	387	0	0	0	0	0	0
OPERATIONS	0	0	0	14	185	1060	2574	2674	2296	2244	2242	2242	2242
TOTAL	7	288	922	2906	3542	4537	3921	2711	2296	2244	2242	2242	2242

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Moore County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	28	1137	3264	7320	8026	9351	3786	145	0	0	0	0	0
BASE CONSTRUCTION	0	0	372	4083	5210	4361	1528	0	0	0	0	0	0
OPERATIONS	0	0	0	56	728	4178	10147	10544	9051	8846	8839	8839	8839
TOTAL	28	1137	3636	11458	13964	17890	15461	10689	9051	8846	8839	8839	8839

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Moore County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU. FT) OF POPULATION LIVING IN COMMUNITIES

Moore County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	43	1739	4993	11198	12277	14305	5792	222	0	0	0	0	0
BASE CONSTRUCTION	0	0	569	6246	7971	6671	2337	0	0	0	0	0	0
OPERATIONS	0	0	0	85	1114	6391	15523	16130	13846	13533	13522	13522	13522
TOTAL	43	1739	5562	17529	21363	27368	23652	16351	13846	13533	13522	13522	13522

POPULATION

Oldham County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	1	3	21	66	149	273	383	272	51	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	5	0	0	0
TOTAL		1	3	21	65	149	273	383	272	51	5	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Oldham County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2	5	38	118	267	489	686	487	91	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	9	0	0	0
TOTAL	2	5	38	118	267	489	686	487	91	9	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Oldham County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	21	148	466	1052	1927	2704	1920	360	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	35	0	0	0
TOTAL	7	21	148	466	1052	1927	2704	1920	360	35	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Oldham County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Oldham County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	11	32	227	71[illegible]	1609	2748	4136	2938	551	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	54	0	0	0
TOTAL	11	32	227	71[illegible]	1609	2748	4136	2938	551	54	0	0	0

POPULATION

Parmer County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	55	104	535	983	1189	956	0	0	0	0	0
	COMMUNITIES	7	39	231	612	1600	2599	3041	2461	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	141	288	315	342	283	233	123	124	338	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	13	0	0	0
TOTAL		147	326	601	1138	2418	3814	4352	3540	338	13	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Parmer County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	13	70	414	1095	2866	4654	5446	4407	0	0	0	0	0
BASE CONSTRUCTION	252	516	564	613	510	417	220	222	605	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	23	0	0	0
TOTAL	265	586	978	1708	3375	5071	5665	4629	605	23	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Parmer County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	49	275	1631	4318	11299	18349	21470	17375	0	0	0	0	0
BASE CONSTRUCTION	995	2033	2224	2417	2009	1644	867	874	2386	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	92	0	0	0
TOTAL	1045	2309	3855	6735	13308	19994	22337	18250	2386	92	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Parmer County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Parmer County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	76	421	2495	6605	[illegible]	28071	32845	26581	0	0	0	0	0
BASE CONSTRUCTION	1523	3110	3402	3698	[illegible]	2515	1326	1338	3650	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	140	0	0	0
TOTAL	1598	3532	5897	10303	[illegible]	30586	34172	27918	3650	140	0	0	0

POPULATION

Potter/Randall COs. Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	2202	4261	6547	8471	10877	13946	15775	13325	7338	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	72	1109	1393	1209	443	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	5829	5788	5788	5788
TOTAL		2202	4261	6619	9580	12269	15154	16218	13326	7338	5829	5788	5788	5788

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Potter/Randall COs, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3943	7630	11722	15167	19477	24971	28247	23860	13139	0	0	0	0
BASE CONSTRUCTION	0	0	130	1987	2494	2166	793	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	10437	10364	10364	10364
TOTAL	3943	7630	11852	17154	21971	27136	29040	23860	13139	10437	10364	10364	10364

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Potter/Randall COs, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	15546	30082	46218	59801	76792	98453	111372	94073	51805	0	0	0	0
BASE CONSTRUCTION	0	0	511	7833	9832	8539	3125	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	41152	40862	40862	40862
TOTAL	15546	30082	46729	67633	86624	106992	114497	94073	51805	41152	40862	40862	40862

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Potter/Randall COs, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Potter/Randall COs, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	23782	46019	70705	91483	117477	150614	170376	143912	79251	0	0	0	0
BASE CONSTRUCTION	0	0	781	11982	15041	13063	4781	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	62754	62511	62511	62511
TOTAL	23782	46019	71486	103465	132518	163676	175157	143912	79251	62754	62511	62511	62511

POPULATION

Sherman County, Tx		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	54	251	799	935	1432	1259	273	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	25	1	0	0	0
TOTAL		0	53	250	800	936	1432	1259	273	25	1	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Sherman County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	97	449	1431	1674	2564	2254	489	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	45	2	0	0	0
TOTAL	0	97	449	1431	1674	2564	2254	489	45	2	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Sherman County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	381	1772	5641	6601	10110	8888	1927	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	176	7	0	0	0
TOTAL	0	381	1772	5641	6601	10110	3888	1927	176	7	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Sherman County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Sherman County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	583	2711	8627	10098	15466	13597	2948	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	270	11	0	0	0
TOTAL	0	583	2711	8629	10098	15466	13597	2948	270	11	0	0	0

POPULATION

Swisher County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	2	8	21	50	87	124	235	277	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	46	3	0	0	0
TOTAL	2	8	21	50	87	124	235	277	46	3	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Swisher County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	4	14	38	90	156	222	423	496	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	82	5	0	0	0
TOTAL	4	14	38	90	156	222	423	496	82	5	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Swisher County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	14	56	148	353	614	875	1666	1956	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	325	21	0	0	0
TOTAL	14	56	148	353	614	875	1666	1956	325	21	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Swisher County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Swisher County, Tx	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	22	86	227	540	940	1339	2549	2992	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	497	32	0	0	0
TOTAL	22	86	227	540	940	1339	2549	2992	497	32	0	0	0

POPULATION

Chaves County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	151	347	771	808	717	0	0	0	0	0
COMMUNITIES	1	9	11	1010	2331	3811	3989	3256	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	9	11	1161	2679	4581	4797	3972	0	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Chaves County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2	16	19	1788	4127	6747	7062	5764	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	16	19	1788	4127	6747	7062	5764	0	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Chaves County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	63	77	7064	16303	26654	27899	22772	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	7	63	77	7064	16303	26654	27899	22772	0	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Chaves County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Chaves County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	11	97	119	10920	25203	41206	43130	35205	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	11	97	119	10920	25203	41206	43130	35205	0	0	0	0	0

POPULATION

Curry County, N M		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	360	1344	3181	4597	4542	1531	357	183	0	0	0	0	0
BASE	CAMPS	675	1431	1595	1713	1361	1105	625	625	125	0	0	0	0
	COMMUNITIES	4283	10830	13938	11665	7130	4764	2291	1635	315	0	0	0	0
OPERATIONS	BASE	0	68	325	3928	8901	11999	11999	11999	11999	11999	11999	11999	11999
	COMMUNITIES	0	129	775	7816	12202	12753	10352	5340	4876	4876	4877	4877	4877
TOTAL		5318	13802	19813	29711	34136	32151	25624	19782	17315	16875	16876	16876	16876

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Curry County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	637	2380	5632	8124	8041	2711	631	324	0	0	0	0	0
BASE CONSTRUCTION	7583	19173	24675	20651	12623	8434	4056	2895	558	0	0	0	0
OPERATIONS	0	228	1372	13837	21602	22578	18327	9453	8632	8632	8634	8634	8634
TOTAL	8220	21781	31679	42613	42266	33722	23015	12672	9190	8632	8634	8634	8634

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Curry County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2516	9401	22250	32096	31767	10708	2494	1279	0	0	0	0	0
BASE CONSTRUCTION	29957	75746	97480	81582	49866	33317	16024	11438	2203	0	0	0	0
OPERATIONS	0	900	5420	54666	85339	89195	72403	37345	34102	34102	34109	34109	34109
TOTAL	32473	86046	125149	168344	166973	133220	90921	50063	36306	34102	34109	34109	34109

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Curry County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Curry County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3889	14533	[illegible]	49619	49111	16554	3855	1977	0	0	0	0	0
BASE CONSTRUCTION	45312	117100	[illegible]	126122	77091	51507	24773	17683	3406	0	0	0	0
OPERATIONS	0	1391	[illegible]	84510	131930	137891	111931	57734	52721	52721	52731	52731	52731
TOTAL	50201	133024	[illegible]	260252	258132	205952	140560	77394	56127	52721	52731	52731	52731

POPULATION

De Baca County, N.M.		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DPA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	61	176	310	607	707	271	0	0	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	41	10	2	0	0	0	0
TOTAL		61	176	310	608	707	271	41	10	2	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

De Baca County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	108	312	602	1075	1252	480	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	73	18	4	0	0	0	0
TOTAL	108	312	602	1075	1252	480	73	18	4	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

De Baca County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	427	1231	2378	4245	4945	1895	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	287	70	14	0	0	0	0
TOTAL	427	1231	2378	4245	4945	1895	287	70	14	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

De Baca County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

De Baca County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	660	1903	3676	6563	7644	2930	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	443	108	22	0	0	0	0
TOTAL	660	1903	3676	6563	7644	2930	443	108	22	0	0	0	0

POPULATION

Harding County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	0	0	0	251	539	864	1136	571	0	0	0	0	0
COMMUNITIES	0	0	0	637	1369	2190	2828	1417	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	159	13	0	0	0
TOTAL	0	0	0	888	1907	3053	3964	1988	159	13	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Harding County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	1128	2424	3877	5007	2509	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	281	23	0	0	0
TOTAL	0	0	0	1128	2424	3877	5007	2509	281	23	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Harding County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	4455	9575	15317	19779	9910	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	1112	91	0	0	0
TOTAL	0	0	0	4455	9575	15317	19779	9910	1112	91	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Harding County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Harding County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	6887	14802	23679	30577	15321	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	1719	141	0	0	0
TOTAL	0	0	0	6887	14802	23679	30577	15321	1719	141	0	0	0

POPULATION

Quay County N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION													
DDA CAMPS	226	455	728	956	710	622	0	0	0	0	0	0	0
COMMUNITIES	602	1230	1967	2849	2692	2683	1442	637	0	0	0	0	0
BASE CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	827	1685	2694	3805	3402	3305	1443	637	0	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Quay County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	1066	2178	3482	5044	4766	4750	2553	1128	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1066	2178	3182	5044	4766	4750	2553	1128	0	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Quay County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	4210	8603	13757	19926	19828	18765	10085	4455	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	4210	8603	13757	19926	19828	18765	10085	4455	0	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Quay County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Quay County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	6509	13299	21268	30804	29107	29009	15591	6887	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	6509	13299	21268	30804	29107	29009	15591	6887	0	0	0	0	0

POPULATION

Roosevelt County, N M		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	72	434	1093	2180	3019	519	0	0	0	0	0	0	0
	COMMUNITIES	410	1860	3713	7281	9538	2419	0	0	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	737	1439	1503	1486	1165	1168	608	551	104	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	14	125	1195	2397	4096	4087	3714	3509	3349	3315	3314	3314
TOTAL		1217	3747	6543	12141	16118	8200	4695	4265	3613	3349	3315	3314	3314

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Roosevelt County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	725	3297	6928	12870	16886	4282	0	0	0	0	0	0	0
BASE CONSTRUCTION	1305	2548	2660	2631	2062	2067	1077	976	184	0	0	0	0
OPERATIONS	0	24	222	2115	4244	7252	7235	6575	6212	5929	5869	5867	5867
TOTAL	2031	5865	9810	17616	23192	13602	8312	7551	6396	5929	5869	5867	5867

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Roosevelt County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	2865	13008	27369	50924	66708	16917	0	0	0	0	0	0	0
BASE CONSTRUCTION	5157	10067	10509	10392	8146	8167	4253	3854	728	0	0	0	0
OPERATIONS	0	96	875	8357	16767	28650	28583	25975	24541	23423	23185	23178	23178
TOTAL	8022	23171	38753	69674	91621	53734	32837	29829	25269	23423	23185	23178	23178

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Roosevelt County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Roosevelt County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	4429	20110	42312	78726	103127	26153	0	0	0	0	0	0	0
BASE CONSTRUCTION	7972	15562	16246	16066	12593	12626	6576	5958	1126	0	0	0	0
OPERATIONS	0	149	1353	12920	25921	44292	44188	40156	37939	36210	35843	35832	35832
TOTAL	12402	35821	59911	107712	141641	83071	50764	46114	39065	36210	35843	35832	35832

POPULATION

Union County, N M		1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
CONSTRUCTION														
DDA	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	22	108	342	368	562	425	75	0	0	0	0	0
BASE	CAMPS	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	BASE	0	0	0	0	0	0	0	0	0	0	0	0	0
	COMMUNITIES	0	0	0	0	0	0	0	0	2	0	0	0	0
TOTAL		0	22	107	342	367	562	425	75	2	0	0	0	0

THE FOLLOWING ENERGY DEMAND TABLES ARE WITHOUT ENERGY CONSERVATION

TOTAL PEAK ELECTRICAL DEMAND(KW) OF POPULATION LIVING IN COMMUNITIES

Union County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	39	191	605	651	995	752	133	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	4	0	0	0	0
TOTAL	0	39	191	605	651	995	752	133	4	0	0	0	0

TOTAL ANNUAL ELECTRICAL ENERGY USEAGE(10**3 KWH) OF POPULATION LIVING IN COMMUNITIES

Union County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	154	755	2392	2574	3931	2972	525	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	14	0	0	0	0
TOTAL	0	154	755	2392	2574	3931	2972	525	14	0	0	0	0

TOTAL ANNUAL OIL USEAGE(10**3 GALS) OF POPULATION LIVING IN COMMUNITIES

Union County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0.	0.	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0.	0.	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0.	0.	0	0	0	0	0	0
TOTAL	0	0	0	0	0.	0.	0.	0.	0	0	0	0.	0

TOTAL ANNUAL GAS USAGE(10**3 CU FT) OF POPULATION LIVING IN COMMUNITIES

Union County, N M	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	238	1168	3698	3979	6077	4595	811	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	22	0	0	0	0
TOTAL	0	238	1168	3698	3979	6077	4595	811	22	0	0	0	0

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ELECTRICAL DEMAND / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

TEXAS	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	5	13	29	54	72	85	70	44	14	0	0	0	0
BASE CONSTRUCTION	1	1	2	12	15	13	5	0	1	0	0	0	0
OPERATIONS	0	0	0	0	1	8	24	26	21	27	26	26	26
TOTAL	5	14	31	65	88	105	98	70	36	27	26	26	26

NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	3	8	17	31	38	24	16	10	0	0	0	0	0
BASE CONSTRUCTION	9	22	27	23	15	11	5	4	1	0	0	0	0
OPERATIONS	0	0	2	16	26	30	26	16	15	15	15	15	15
TOTAL	11	30	46	70	79	64	47	30	16	15	15	15	15

TEXAS AND NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	7	21	46	85	110	109	86	54	14	0	0	0	0
BASE CONSTRUCTION	9	23	29	35	30	23	10	4	1	0	0	0	0
OPERATIONS	0	0	2	16	27	37	50	42	36	41	40	40	40
TOTAL	17	44	77	136	167	169	145	100	52	41	40	40	40

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL ELECTRICAL USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

TEXAS	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	19	52	114	214	283	334	274	172	56	0	0	0	0
BASE CONSTRUCTION	2	4	8	40	59	50	18	2	3	0	0	0	0
OPERATIONS	0	0	0	0	5	30	96	104	83	105	102	102	102
TOTAL	21	56	122	[illegible]	347	414	388	278	141	105	102	102	102

NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	10	32	67	121	151	94	63	39	0	0	0	0	0
BASE CONSTRUCTION	35	86	108	92	58	41	20	15	3	0	0	0	0
OPERATIONS	0	1	6	63	102	118	101	63	60	58	57	57	57
TOTAL	45	119	181	276	311	254	185	118	63	58	57	57	57

TEXAS AND NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	29	84	180	335	434	428	337	211	56	0	0	0	0
BASE CONSTRUCTION	37	90	116	140	117	91	38	17	6	0	0	0	0
OPERATIONS	0	1	6	63	107	148	197	167	143	163	159	159	159
TOTAL	66	175	[illegible]	539	658	667	573	395	204	163	159	159	159

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL OIL USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

TEXAS	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

TEXAS AND NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
BASE CONSTRUCTION	0	0	0	0	0	0	0	0	0	0	0	0	0
OPERATIONS	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0

ENERGY DEMAND WITHOUT CONSERVATION

SUM OF TOTAL ANNUAL GAS USAGE / 10 ** 3 OF POPULATION LIVING IN COMMUNITIES

TEXAS	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	28	79	174	327	433	511	419	264	85	0	0	0	0
BASE CONSTRUCTION	3	6	12	73	91	76	27	3	4	0	0	0	0
OPERATIONS	0	0	0	1	7	46	147	158	127	161	156	155	155
TOTAL	31	85	107	401	531	633	594	425	216	161	156	155	155

NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	15	50	103	187	233	146	98	60	0	0	0	0	0
BASE CONSTRUCTION	54	133	167	142	90	64	31	24	5	0	0	0	0
OPERATIONS	0	2	10	97	158	182	157	98	92	89	89	89	89
TOTAL	70	184	280	427	481	392	286	182	97	89	89	89	89

TEXAS AND NEW MEXICO	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
DDA CONSTRUCTION	44	129	277	514	666	656	517	324	85	0	0	0	0
BASE CONSTRUCTION	57	139	179	215	181	140	59	26	9	0	0	0	0
OPERATIONS	0	2	10	98	165	228	303	256	219	250	244	244	244
TOTAL	101	270	466	828	1012	1025	879	607	313	250	244	244	244

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